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LAND ADMINISTRATION AND CLIMATE RESILIENCY

Covid 19: GIS and Digital Urban Development

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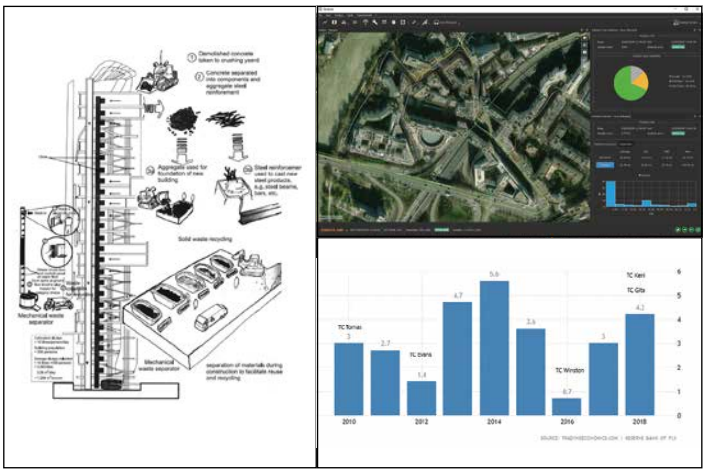

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The chaos

Covid-19 and the havoc thus created.

The world seems to be in fragments

Physically, socially, economically, psychologically…

Palpable uncertainty, uneasiness, anxiety, nervousness, … all over.

Different models are emerging to deal with the situation

Some celebrated, some pre-maturely celebrated and some condemned.

The approach at times is clueless, callous and even criminal.

There is a mad rush to be the first,

To offer solutions - medicines, vaccines, …

Some genuine and some not.

Many have died, many sadly will…

Instead of driven by a collective cause

The mantra has become

To save oneself rather than ourselves.

Bal Krishna, Editor
bal@mycoordinates.org

We offer a consistent, refined, and optimized user experience

Qinertia, SBG Systems' in-house INS/GNSS post-processing software now offers a GNSS license allowing surveyors to post-process both static and kinematic GNSS data. In an interview with Coordinates magazine, Raphaël Siryani, Chief Software Architect and co-founder of SBG Systems talks more about the software

Raphaël Siryani
Chief Software Architect and co-founder of SBG Systems

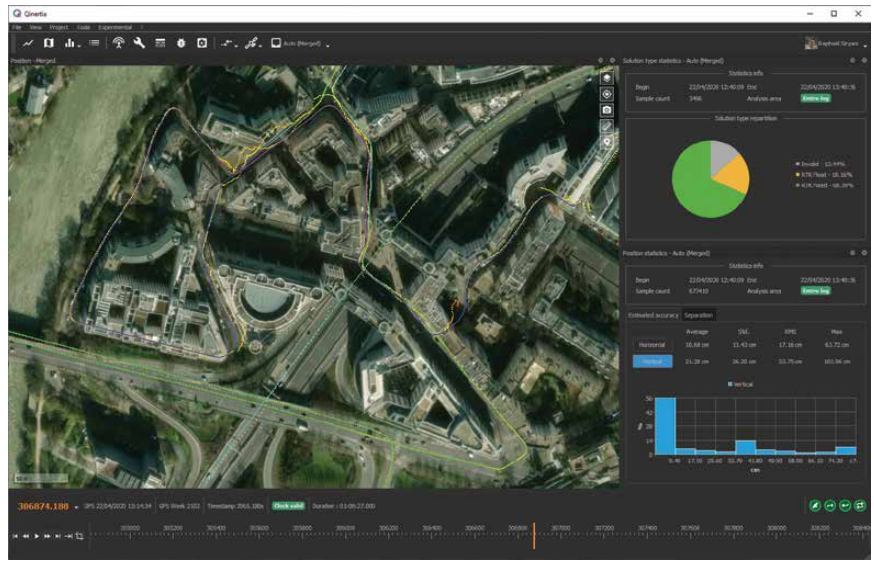
Qinertia supports all major GNSS receivers and is now open to third-party IMUs', could you please elaborate this.

Qinertia has been designed from the beginning to support any GNSS or IMU and offer a unified solution for all post processing needs. However, we wanted to do it step by step and first focus on our own INS solutions to refine the user experience and be very responsive to users' feedbacks.

Since Qinertia was announced in 2018, we have seen a lot of requests to allow processing of third party IMU/INS. The main reason is that our users love Qinertia and some have different INS or GNSS hardware. They just don't want to spend money and time being trained on several INS/GNSS post processing software.

For us, post processing should be an easy and straightforward task. The main complexity with post processing is the diversity of data, files, settings and hardware. Most post processing software relies on the user to handle all this complexity by only supporting RINEX file format.

With Qinertia, we have decided to support natively as many GNSS manufacturers binary protocols as possible. In other words, the user just has to drag and drop the files produced by the GNSS receiver to process them. Qinertia will handle all the import process automatically to ensure data integrity and consistency and deliver data you can rely on.



Up to now, Qinertia support natively Ublox, Septentrio, Novatel and Trimble GNSS receivers. For other GNSS manufacturers, Qinertia can still use RINEX files directly.

Third party IMUs are supported the same way as GNSS data with two levels of integration. For some IMU/INS manufacturers such as Septentrio, we have a tight integration. Qinertia will read all data and settings automatically and handle any frame rotations to ensure a straightforward process. For all other IMU/INS, Qinertia accepts simple CSV text or binary file containing the IMU data, the settings, the true heading information and so on.

Finally, the software is packaged with several IMU error models ranging from entry level MEMS INS to very high-end FOG units so any type of IMU can be processed with Qinertia.

How Qinertia is unique compared to other similar softwares available in the market.

Qinertia offers a very unique user experience and makes kinematic post processing easy and accessible to everyone. We have seen a lot of customers that can save both money and time with post processing but don't want to use post processing as they believe it's complex and time consuming.

Qinertia has been designed with this idea in mind: make GNSS and INS post processing accessible to everyone while delivering very high quality data. The way Qinertia handles and displays data such as trajectory is unique and quite similar to what you can find in video editing software with a timeline. In just a few clicks you can compare data, navigate through time, understand exactly what is going on and assess the data quality with bar charts, pie charts, etc.

Qinertia also offers a very efficient interface to access worldwide GNSS base station databases. The user can view automatically surrounding base stations in a nice looking satellite maps view. Qinertia downloads, checks, and process all data automatically. It's the same for INS project settings such as lever arm. We have tried to ease this process as much as possible with built-in automatic lever arm and alignment estimation tools.

Finally, exporting data out of Qinertia is very easy with our nice looking ASCII file format generator tool. Just drag and drop the fields you would like to export and that's it. Now Qinertia is open to third-party IMU and offers both GNSS and full INS computations. It's a unique software combining both ease of use, high quality results, and openness to all IMU and GNSS.

How does Qinertia prove advantageous to surveyors, GIS professionals or photogrammetrist ?

SBG Systems is the only company to handle the whole navigation and geo-referencing solution from the Inertial Measurement Unit manufacturing (selection, assembly, test and calibration of accelerometers, gyroscopes, magnetometers, and GNSS) to tightly coupled GNSS/INS algorithms packaged in an easy-to-use post processing software. This allows us to get the most out of an IMU so we can offer a hardware and software solution that is smaller, lighter, and cost effective.

This is especially interesting for UAV-based jobs where the payload size and weight directly impact your mission time. Because we know exactly how the IMU behaves, and we handle the GNSS algorithms ourselves, we are able to finely compensate for IMU sensor delays within Qinertia and guarantee perfect synchronization between a Lidar and the INS data.

Qinertia is also easy to use and requires very few knowledge to successfully process GNSS/INS data which improves productivity. The quality assessment tools packaged with Qinertia are also very important to help surveyors guarantee the delivered data accuracy.

Qinertia is able to support any GNSS or IMU as well as export to any third party software, so users can safely invest time and money knowing that all missions can be done with the same software. Finally, new features planned later for this year will even make surveyors life easier such as Virtual Base Station, corridor processing and improved photogrammetry tools.

What kind of R&D went into the development of Qinertia?

Software development has always been a very important part for SBG Systems and Qinertia is the result of intensive work and efforts done for the past 5 years. When we have first think about Qinertia, we wanted something new compared to established post processing software with a much more interactive, user friendly and graphical user interface.

For instance, Qinertia is the only software on the market able to display graphically all epochs (200 per seconds) and let the user freely navigate, zoom or even playback the mission.

You can even do all these stuffs while Qinertia is processing the data with no freeze or hangs! To better visualize the amount of data we are talking about, for a 24-hours log, Qinertia is able to display and manage in real time more than 17 millions entries.

To do so, we have used the exact same technologies as the ones you could find in 3D game engines and we take advantage of modern GPU/CPU with a massively multi-threaded 64-bit architecture.

All the algorithms used in Qinertia are designed in close relationship between the software team and the algorithm team. As a result, we can offer a consistent, refined, and optimized user experience with very fast processing times, extensive quality indicators, and unrivalled accuracy.

Covid 19: GIS and Digital Urban Development

Covid 19 pandemic has caused massive destruction of the economy, livelihoods and reverse migration of the labour. It has underlined the need to adopt digital order, online communication and health as the focus of urban development

A K Jain
Worked as Commissioner (Planning), Delhi Development Authority and as a member of the Committee of the Ministry of Housing and Urban Affairs on the DDA (2015). He was as a member of UN Habitat (2007-12). Author of several books, he is visiting faculty in planning and architecture. He was awarded 2nd Urban Professional Award 2014 at World Urban Forum in Medellin, Colombia and IBC Lifetime Achievement Award (2016)

Covid-19 is once in a century pandemic. It has caused massive disruption to the economy and the livelihoods, especially of those living and working in the informal sector. Their income sources have vanished. Most of them live in high-density slums which lack space, sun, air, clean water and sanitation. The Covid pandemic has exposed them to the epidemiological, transitional, health, hygiene and survival vulnerabilities.

It is estimated that the Covid 19 pandemic has resulted in loss of 200 million jobs of daily wagers. During the lock down, from 25th March 2020 to 31st May 2020, about 200 migrants died due to exhaustion and accidents. There has been severe shortage of public transport, shelter, food and for the migrant labourers. With public transport shut down, the workers walked and cycled hundreds of kilometres or travelled in autos, trucks, and even concrete mixers. It was quite late to provide special shramik trains.

There has been glaring lack of GIS database, digital order and information on virus sources. According to Chief Labour Commissioner 2.6 million migrants are stranded, whereas the Solicitor General informed the Supreme Court that 9.7 million have been transported back home. Other estimates vary widely-30 million (Chinmay Tumbe), 5 million (Dr. Noman Maajid, ILO), and 22 million according to Amitabh Kundu. No GIS surveys, satellite imaging and geo-spatial mapping have been carried out to identify the sources of corona virus and hotspots. Declaration of such areas has been based on commonsense and patient counts. We know that the pandemic was spread largely by those travelling abroad, which should have been the priority of the lockdown. The real time, geospatial data is vital to gain a robust understanding of the Covid 19, its causes and effects.

India's 7936 cities and towns, having a population of 377 million, generate 60% of GDP and 70% of the jobs. According to 2011 census, 2613 cities have 13.9 million slum households with a population of 65.4 million. With diminishing returns from agriculture, people are migrating to urban areas for jobs, better facilities and livelihoods. However, There has been severe shortages of housing and health facilities. The commuting distances keep on increasing due to indiscriminate urbanization. Most of the migrants work in the informal sector as domestic servants, labour, vendors, construction workers and live in crowded, cramped and congested slums.

According to the National Sample Survey Office (NSSO) 76th round (2018) 80% rural houses and 62% urban houses in India have one room or less. 75% of rural households and 40% of urban households do not have access to tap water, 45% of rural and 9% of urban households are without washrooms/latrines. This means that norms of social distancing, self-isolation and regular hand washing are difficult to be observed by majority of households.

The Covid 19 pandemic in India raises the following questions:

- Whether the focus of urban development should change towards healthy environment and housing?

- Whether the medical approach towards the pandemic should link more closely with the GIS and digital order?
- Whether the virus could be controlled by the lockdowns, quarantine, facemasks, social distancing, etc.?
- Can there be long term strategy to deal with the vexing migrants' issues, and a targeted eco-system for their resettlement, either as the fifth vertical of the PMAY (Urban), or by a new participatory women and children focussed cooperative model?

Healthy environment

According to UN Habitat and World Health Organisation (2020), *if the purpose of planning is not for human and planetary health, then what it is for?* The concern for human health and well-being is the focus of planning of the built environment.

Building regulations and urban planning are closely related to public health. After the industrial revolution, during the 18th and 19th century, the unhygienic conditions prevailed in the cities of Western world. As a result, the concepts of town planning, zoning, land use controls and building regulations were developed to safeguard public health, safety and convenience. In India, building regulations came in 1880s and modern town planning in 1900s.

Health had been a determining factor in the selection of the site of New Delhi, the new Capital of India. Earlier, in 1911 a site was selected at Kingsway Camp on the bank of river Yamuna, towards North of Civil Lines. It was dropped being malaria-prone, low lying and water logged, and a new site at Raisina was selected for its better drainage and health conditions.

The public health depends largely on a pollution free environment with adequate services, housing and workspaces, free from sick building syndrome (SBS). The indoor and outdoor environment should not cause rheumatic complaints, fever, fatigue, respiratory diseases, asthma, etc. due to microbial, allergy, toxins, dust and mites. These spaces should be comfortable with proper ventilation, sun and temperature control.

This involves the following:
- Basic planning standards and codes
- Spatial frameworks
- Digital planning and urban processes

This needs adopting the following principles:
- Foster adequate levels of compactness and well-connected places
- Create urban environments that are more socially inclusive
- Design human settlements that are less demanding on resources and are more resilient

With the Information Technology (IT), the urbanism and buildings have become information exchange system. The buildings form a symbiotic and organic relationship with the elements of nature-earth, water, sun (energy), space and sky. The computation and big data analytics capture the complex multi-dimensional interaction of the elements of nature and evolve the tectonic solutions based on the urban issues and needs of the people.

Healthy and sustainable development involves reducing emissions from transport, power and industries, incineration of wastes, dust, etc. Such a city is planned on the principles of compact and dense development, intelligent traffic management, transport demand management, efficient, comfortable and non-polluting public transport, bicycles and non-motorised transport (NMT) and walk to work. The urban plans should incorporate low carbon transit system, zero net energy buildings, black hole technology of waste management and smart utilities. Intelligent and smart systems, viz. Big Data Analytics, Supervising Control Data Acquisition Systems (SCADA), ERP solutions, GIS, Integrated Digital Control/ Command Centres and Satellite Surveillance can be exploited for epidemic and air pollution control.

According to the Intergovernmental Panel on Climate Change, urban areas account

Table 1: Fostering sustainable urban and territorial planning: Five qualifiers

Health as an input	Health as an outcome
1. Planning more compact places	
Mitigating any risk to health from what may be seen as "crowding" and allaying associated fears. Providing local data on health impacts and evidence for risk mitigation strategies for situations where high densities can lead to adverse health outcomes.	Supporting active mobility, public transport and social interactions and reduce use of energy and resources.
2. Planning more socially inclusive places	
Ensuring that diversity is supported in placemaking through spatial planning variety such as in land parcel size, forms of land tenure, and size of housing. The health workforce can mobilize action and inspire communities to join planning and enjoy places.	Supporting the well-being and resilience of vulnerable sub-populations, across the life-course and across socioeconomic and cultural groups. Reducing inequalities and ensuring adequate access to health.
3. Planning better connected places	
Vulnerable populations and resources that support health are not distributed evenly. Health data can assist in identifying where better connections need to be made, and at many scales.	Facilitating better health through access to economic opportunities, amenities and services. Reducing individual and family stress of long commutes and promoting active travel. Reducing community severance.
4. Planning places that are more resilient to climate change and natural disasters	
Supporting action to help reduce vulnerability to human and material loss by climate-induced disasters, including through changes in health care facilities and health care preparedness and response to disasters. Highlighting the links between health and climate damaging environmental risk factors, such as air pollution. Providing data and guidance where climate-related health risks, e.g. heat stress and food insecurity (at the bigger scale), place populations or sub-populations at risk.	Both direct and indirect health benefits, for example, through well-designed and accessible green, blue and public open spaces which also acts as buffer zones and functional landscapes. Designing health benefits into nature-based solutions for ecosystem services, climate mitigation and resilience. Focus on near-term solutions that will immediately deliver on health while also reducing climate change, such as air pollution mitigation.
5. Institutionally integrated planning	
Increasing capacity for vertical and horizontal integration and participation through the development of health decision support tools and approaches, to inform and integrate decision-making processes for land use with other relevant sectorial policies and interventions. Examples include: HiAP, health and health equity impact assessment and a number of specific health risk calculation tools.	More effective management and responsiveness of planning, focusing on responses to health risk and health equity, as well as the distribution of health impacts and the appropriate vertical and horizontal integration to address them. Better integration of routine assessment of potential health benefits/risks and evaluation of health impacts of urban environment interventions with the planning system.

Source: UN Habitat and WHO (2020) Integrating Health in Urban and Territorial Planning

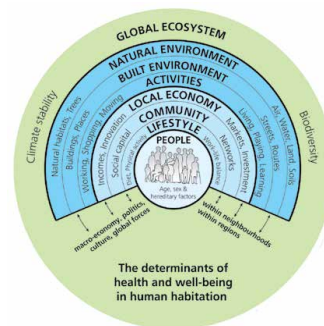


Fig. 1: Health vis-à-vis Planning of Human Habitation
Source: UN Habitat and WHO (2020) Integrating Health in Urban and Territorial Planning (2020) & Barton and Grant (2006)

for 67 to 76% of global energy use and 71 to 76% energy related CO_2 emissions. According to the IPCC (Climate Change Report, 2014, WG III) the critical aspects of spatial planning comprise:

- Density, FAR optimisation
- Land use (mix of activities, population)
- Connectivity, walkability and traffic density
- Accessibility for all by public transit, cycle, walk

Location is most important for the livelihoods of the informal sector workers who cannot afford to lose time and money in commuting. As a principle, the distance between work and living should be below 15 minutes by public transport, cycle or walk, that is 10 km, 3 km, and 1 km respectively. In view of recent work from home trend due to corona lockdown, it may be mandatory to provide at least half of the built space for work-life integration and mixed land use. This will save the need to commute.

Prof. Richard Sennett of the MIT states that *"on the whole density is a good thing. Denser cities are more energy efficient."* London School of Economics in its study "Experiencing density living in a denser London" (March 2020) found that '*surprisingly residents' satisfaction with their housing has little relation with their aesthetic quality. The degree of density also does not corelate with how much they like their homes. Rather, a building's internal design and comfort are most important.'* The study has also redefined the density in terms of habitable rooms as below:

- High 100du/400 habitable rooms/Ha
- Super dense 150du/ 500 habitable rooms/Ha
- Hyper dense 350 du/1000 habitable rooms/Ha

Health Infrastructure

The urban development and environment have profound effects on the health of the population. The determinants of health and well-being in human habitation encompass climate stability, global eco-system and biodiversity. The global and local systems telescopically converge at the people, lifestyle, community, local economy, work, natural and built environment.

In terms of urban planning these include the following:

i. Land use and density pattern.
ii. Health facilities and standards.
iii. Provision of open space, public spaces and greenery.
iv. Development of sports facilities and play fields.
v. Physical infrastructure, water supply, electricity, sewerage, solid waste management and drainage.
vi. Conservation of natural geographical features- heritage, river and water bodies.
vii. Development controls and building byelaws.
viii. Regularisation and rehabilitation of unauthorised colonies, housing and slums
ix. Traffic and Transportation.
x. Air and Water Pollution Control.

A healthy city depends upon integrity of land uses and safeguarding adequate open spaces and protect living and working areas from hazardous and polluting activities, such as, industry, heavy traffic, wholesale trade, etc. The land use plan and density pattern should strike a balance between the aspects of crowding, health and traffic generation, besides conserving the tree-studded and garden city character.

According to the recommendations of the World Health Organization (WHO), the bed population ratio to be achieved is 5 per thousand persons, whereas in 2011 the bed persons ratio in Delhi is 2.55. There has been very little increase in the number of beds per thousand persons over the last 20 years. It is estimated that the total number of hospital beds required in Delhi in the year 2021 will be about 115,000.

The following can be proposed in order to meet the requirements of health related infrastructure:

i. Enhancement of Floor Area Ratio (FAR) for health facilities
ii. Promoting rebuilding of the old hospitals
iii. Shifting of contagious diseases hospitals from urban areas to the urban extensions and NCR with proper seclusion and connectivity
iv. Permitting hospitals, health centres, nursing homes, dispensary, mohalla clinics, path labs, etc. under mixed use and other uses, viz. industrial, commercial and residential.
v. Dedicated Centres for Senior Citizens and Mentally Challenged, maternity home, nursing home, family welfare centre, polyclinic, paediatrics centre, geriatric centre, diagnostic centre, etc.
vi. Health facilities may include Ayurvedic/Homeopathic/Unani and other streams of treatment.

Rehabilitation, housing and health

The worst affected by the epidemic are the slum dwellers, who do not have adequate space and services and live in overcrowded, dilapidated dwelling units. Often the planning norms force their eviction and shifting to far off locations from their workplace. Therefore, the density is important for efficient use of land with minimum building footprint, especially for the projects of in-situ rehabilitation of slums.

The present scenario of the migrant labour reminds of 1947 when about 50 million refugees crossed into partitioned India. The Government of India created the Ministry of Refugees (later Ministry of Rehabilitation) which provided immediate relief- food, shelter, medicines, water and sanitation facilities. Simultaneously, livelihoods - kiosks, shops, work sheds, small scale /household industries and homes were provided to the refugees. The refugees in Delhi were resettled in 36 Rehabilitation Colonies with about 70,000 plots of 80 sqyd, besides 15,000 shops. Similar approach is needed to rehabilitate

migrant labours. They are valuable assets and builders of city and homes. However, in place of plots for individual families, group housing on cooperative basis should be promoted for a composite community development. As the Master Plan for Delhi stipulates minimum 2000 sm plot with 400 FAR, which provides 8,000 sm of built-up area, i.e. 160 dwelling units, along with 800 sm for about 50 shops/ work sheds and 800 sm for community facilities, such as creche, nursery school, community halls, dispensary, etc.

The Niti Aayog projects that per capita residential space in India will increase from 5.9 m^2 in 2012 to 35 sqm in 2047. This means a drastic revision of spatial standards of the houses of poor along with an optimally compact and dense urban pattern. The shelter must be adequate, healthy and affordable, along with rental option as the poor can't afford paying the EMI.

Healthy housing supports a state of complete physical, mental and social well-being, relying on the immediate housing environment, and the extent to which this provides access to services, green space, and active and public transport options, as well as protection from waste, pollution and the effects of disaster, whether natural or human made. For housing to be adequate, the following seven criteria must be met: security of tenure, availability of services, materials, facilities and infrastructure, affordability, habitability, accessibility, location and cultural adequacy. The housing should cater especially women, children and the aged ((UN Habitat & WHO, 2020).

Sustainable and healthy environment manifests climatic comfort and air quality with buildings free from sick building syndrome (SBS) caused by microbial, allergy, toxins, dust and mites. The wall between work and life should be dismantled by a composite, mixed land use.

In the context of impending pandemic, pollution, waste generation and water shortage, it is time to conceive the buildings, which detox the air, work as bioreactors and energy generators. They provide water loops for conservation of rainwater, provide space for waste treatment, and promote urban agriculture. Like food pyramid, building materials pyramid can be developed to identify the materials with least environmental footprints. The buildings should be able to produce their own food, water and energy, and are light, flexible and self-sufficient.

The buildings are healthy, environmentally responsible and resource-efficient through their life-cycle, if they integrate the following:

- Sustainable and healthy site planning, location, density, mobility, living-work relationship and building regulations
- Building envelope and built space, social distancing, privacy and safety
- Energy conservation, renewable energy and net-zero energy buildings
- Indoor quality, ventilation, sun and thermal comforts
- Sustainable building resources with high recycled and renewable content and low VOCs emissions and odour
- Reduced building footprint, depletion of natural resources and biodiversity
- Building services and HVAC (heating, ventilation and air conditioning), lighting, water sanitation, etc. According to the Covid 19 Guidelines for Air-conditioning and Ventilation, issued by the CPWD (22.4.2020), low temperatures are optimal for air-borne influenza virus survival, which decreases progressively at higher temperature. As such, room temperature should be set at 24^0 to 30^0 C, humidity of 40% to70% with fresh air flow to inactivate aerosol droplet virus.

Buildings as respirational system

Buildings can be designed as huge air-purifiers, which transform the polluted air and exhaust fumes into clean air by water algae and sea sponge. These contain organisms that convert greenhouse gases and exhaust fumes into oxygen.

Urban nebulizer is a device to aid breath for an asthmatic. It takes temperature inversion, smog and polluted air of atmosphere and diffuses it by smokestack, combined with water vapour. The structure can also function as a botanical garden, mostly with acicular trees for air purification.

Detox tower: A building can double as a detox tower which cleans air through its outer skin and internal detox loop. The detox tube has three layers- the first is Voronoi/ aerodynamic adaptable structure, the next is a nano-hydrophobic membrane layer with venturi that uses lichen and algae for purification purposes. Finally, the air passes through layer three, which comprises a flexible aerogel. The building can be designed to give the chimney effect, which cools the air entering at its base and flows out at the top, cooling the whole structure. The building skin also collects solar energy.

Energy bioreactor

Bioreactor gathers CO_2 from the industrial, organic wastes and auto emissions, which gets converted into energy by water, sunlight and algae. CO_2 produced by the process also runs back to energise the bioreactor, raw products, and to create biodiesel, hydrogen fuel, and animal feed, besides hydrogen, water and oxygen. The building façade is an Algae Bioreactor**,** that makes it a zero-net energy building.

Noise and heat insulating panels, made of carbon fibre and cyano bacteria, create a closed autonomous system of air circulation within a building, protecting it from outer pollution by providing fresh ionized oxygen. The exterior should be able to open and close. Within these modules, the cyanobacteria grow. The modules are filled with a 'special water solution' that reacts with carbon dioxide to produce oxygen by photosynthesis process.

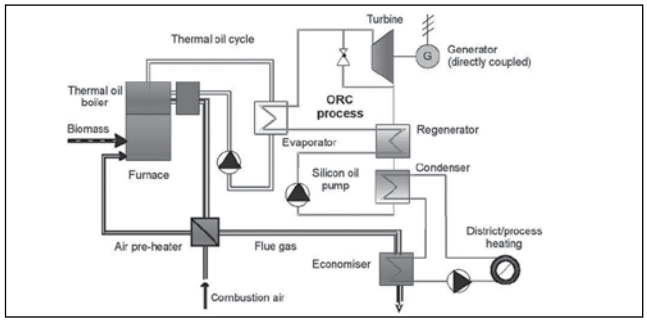


Fig. 2: Gasification Process: Electricity from Bio-mass
Source: Trashscraper, David Constable, 2012

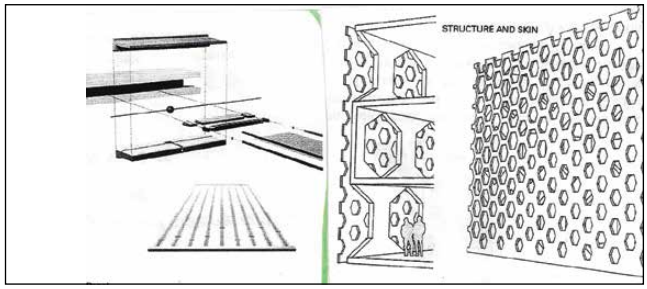


Fig. 3: Acoustic Panel and Urban Coral Reef Skin for Energy from Noise
Source: Ryan Browne, Nathaniel Dunn, Daniel Nelson & B. Scholten, Urban Transducer, and Amandine Quillent, F Zaini, Urban Coral Reef, in Evolo Skyscrapers, 2012

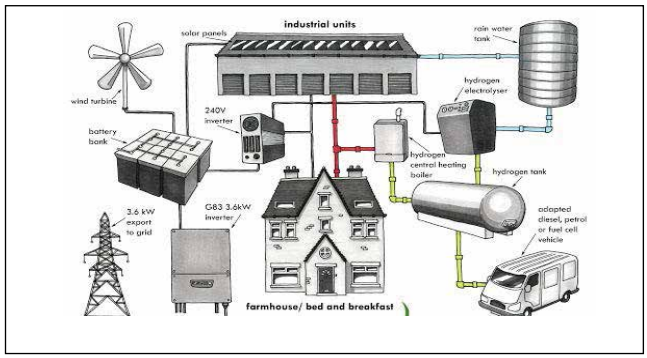


Fig 4: Wind Turbines, Solar Parabolic and Microgrid
Source: Jain, A.K. (2015) The Idea of Green Building, Khanna Publishers, New Delhi.

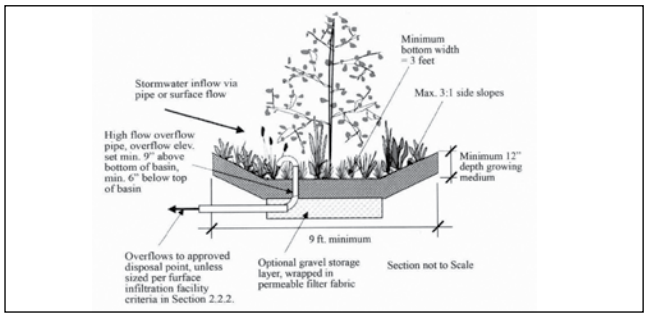


Fig. 5: Infiltration basin
Source: Jain, A.K. (2015) The Idea of Green Building, Khanna Publishers, New Delhi.

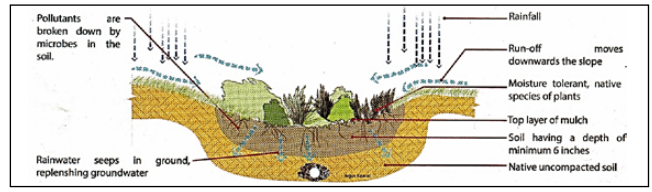


Fig. 6: Bio-swale Captures Rainwater and Recharges Groundwater
Source: Jain, A.K. (2015) The Idea of Green Building, Khanna Publishers, New Delhi.

Water conservation and evo-transpiration

With increasing urbanisation, pollution and loss of biodiversity, there is an increasing shortage of potable water. There is a need to adopt an ecosystem and watershed approach, which includes the water recycling, rainwater harvesting, desalination and purification of salty/brackish water, conservation of water sources, rivers and lakes, controlling extraction of groundwater, micro- irrigation, water efficient, plumbing and fixtures, and fiscal and management reforms.

Grey water treatment by root zone system using urban forestry and nutrients can produce evaporation-transpiration. The irrigation system is 1 m below ground to reduce evaporation losses, pollution and to prevent odour. The vegetation cools the environment. An adult beech (Fagus Sylvatica) has a cooling power of 1,000 mega-joules per day. Each litre of water evaporated by a tree produces 2,300 kilo joules (0.64 kwh) of cooling. By proper design, we can use this energy to cool buildings, in addition restoring the nature. The plants species for cooling should be suitable for suction of particulate, evapo-transpiration and wastewater treatment.

Water reservoirs in the form of funnels, rain gardens, swales and reed fields serve as a hydro-botanic treatment unit. The rainfall stored in a reservoir and treated wastewater can be used for flushing toilets, washing machines, watering plants, cleaning floors and other domestic applications.

Waste-scrapers

With ever-enhancing wastes and diminishing landfills, it is necessary that the waste is segregated, treated and recycled at local levels. Vertical waste scrapers can be alternatives for automated waste collection and recycling. A modular structure, which can be compressed like an accordion, can be erected as a battery of movable waste containers. Such structures can also be used for slum rehabilitation, emergency shelter and essential facilities like police and fire station.

The waste-scraper modules separate the leachate and other wastes for treatment, recycling and composting. The waste-scrapers will have a programmed skin with a gasifier. The

gasification process uses an oxygen starved high pressure and high temperature environment to remove impurities before its combustion. The wastes are filtered and processed separately. The decomposition and formation of organic wastes produce methane gas, which is used for fuel.

Composting reduces transportation costs and emissions as well as providing valuable compost for local needs. Containerised compost allows emission free composting on site. With pre-sorting, the recyclates can be containerised and sent to processing facilities. An interpretation centre is located at the base of the structure. The conceptual basis of the project is recycling of waste, least impact on environment, and providing amenities to the local community.

Urban agriculture

For urban agriculture multi-level platforms can be created along with micro-irrigation and humidifying mechanisms. Methanisation of organic wastes, air supply and photovoltaic systems provide supports to the idea of urban farming and artificial urban biotope. This can help in availability of organic produce locally, reduce haulage and wastage of agriculture produce and bring greenery in the midst of concrete jungle.

Building resources and sustainable construction

The idea of circular economy is based on the continuity of raw materials, products and waste streams in a closed circular loop. It involves an energy centered approach towards design, materials and construction. Adoption of circular models for the building design and construction requires formulating guidelines, calculating resources, labour and material flows, their environmental footprint and impact and lifetime scenarios. The basic approach of circular construction is zero emissions and wastes by on-site recycling to save the environment.

In the up-cycle scenarios, the materials are critically analysed to make sure that they do not cause any ecological damage. This involves a new design thinking and adaptation of architectural designs based on reversible solutions, the reuse and recycling of building components and wastes. Life cycle analysis (LCA) and Life Cycle Costs (LCCs) are the basis for absolute sustainability. The approach begins with the reduction of materials consumption, their recycling and reuse considering the following:

- Prioritise renewable, bio-based materials over non-renewable materials
- Avoid environmentally harmful materials and construction processes
- Use green energy sources
- Ensure that such resources are included in the standards, specifications, technologies and biological circuits
- Incorporate the social and cultural dimensions of green transition.

Fig. 7: The Building Materials Pyramid
Source: Cinark, Kdak (2019) Circular Construction Materials, Architecture Tectonics, Unwelt, Udgivet, Copenhagen, Denmark

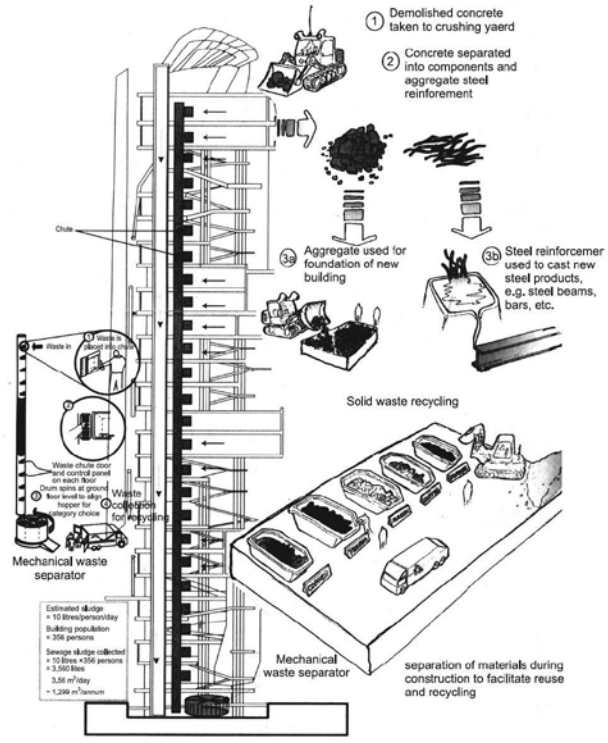


Fig. 8: Concrete Recycling, Editt Tower, Singapore
Source: Hamzah TR and Yeang, Ken, Ecology of the Skyscrapers (2001), Bawttle McCarthy, Consulting Engineers

In view of the labour shortage after covid 19, resort to automation, prefabrication/ pre-engineered construction and computer aided manufacturing. As a thumb-rule, manpower utilized in building construction should be reduced to half by these systems. Akin to the concept of food pyramid, the building materials pyramid shows the environmental impact of various materials.

Construction and demolition (C & D) waste recycling

Construction involves generation of construction and demolition wastes. These need to be disposed of and recycled as per the Construction and Demolition Waste Management Rules, 2016. Recycled products reduce the demand for new materials. Such materials include reused brick, steel, concrete, gypsum, sulphur, wood alternatives, reconstituted wood, straw, bamboo, wood waste pallets and panels for construction. The C&D waste as a resource and should be:

- Segregated at site and exclude the inert, chemical or hazardous wastes. such as oil, paint, batteries and asbestos
- Recovery from recyclable wastes, such as plastics, timber, steel, aluminium, bricks, wood, concrete, etc.
- Energy production from organic, bio-degradable wastes.

There are several examples of successful use of C & D waste in new buildings, e.g. Editt Tower, Singapore and New Moti Bagh Government Housing Complex, New Delhi. As a thumb rule about one-fourth of building materials should be recycled from C & D wastes.

Automation, Building Information Modeling (BIM) and Computer Aided Manufacturing (CAM)

During recent times the purpose of automation has been shifting from increasing productivity and reducing costs to broader issues, such as increasing sustainability, energy efficiency, reducing dependence on manual labour, quality and flexibility of the building. Automation and robotics are being used in construction for prefabrication of building components for speed, accuracy and customization. The flexible production system using robotic can execute various tasks, such as setting moulds, placing reinforcement bars or mats, concreting of floor, roof, wall, beams and columns. Construction robots supplement skilled labour and to achieve construction speed, precision and quality for jobs like concrete and steel structural erection, external and internal finish work, maintenance and demolition work, etc. A new surge has led to Computer- Aided Manufacturing (CAM) and Computer Integrated Manufacturing (CIM) for prefabricated components, ceilings, walls, roofs, etc.

As building design and construction are becoming more complicated with smart materials, services and digital networks,

understanding and tracking various systems have become crucial. Building Information Modeling (BIM) provides computerized layers of information, planned details of the structure, 3D drawings, planning documents, service plans, specifications of building materials, components, light fittings and fixtures. BIM is an integrated, collaborative process that enables engineers, architects, contractors and clients to work from a single, digital model and share reliable, coordinated information at every stage of a project life cycle.

Smart utilities and services

Smart utilities and services include energy, transportation, waste prevention and recycling, air quality and water quality, which are low carbon and efficient. The term "smart utilities" denotes integrated, scalable systems which are instrumented, with sensors and controls are embedded for its operations. It is interconnected, enabling the two-way flow of information across the network, using analytics and automation to turn data into insights and to manage resource more efficiently. Smart services are also more resistant to attacks and natural disasters. They can anticipate, detect and respond to the problems quickly.

Smart utilities aim at high quality water supply, drainage, sewerage, streets and waste management. For water supply, the ICT solutions, such as SCADA system, enable enhanced efficiency and transparency. Similar benefits are available in respect of solid waste management and other utilities. ICT controlled three bins recycling, park and lawn micro-irrigation system make the utilities efficient.

Smart utilities can give energy saving up to 30%, reduce carbon emissions and provide higher efficiency and comfort. Information technology can be used for better services, high-speed communication and data management, carbon-emission accounting and performance objectives.

The idea of healthy habitat and building involves using the ICT, smart systems and morphotectonic strategies of planning, which enhance public health, hygiene and well-being.

Global Positioning Systems (GPS) can simulate the entire construction sequence, sustainability issues and reducing waste by choosing the best option. These helps in precision in construction, laying underground services or cut exactly a panel or glass by satellite-guided tools.

GPS device can be attached to equipment grading the road. A GPS-linked device indicates whether the grading is being done in the right place, or it is too deep. On site virtual system, endless that the pipe work installed in a building is inspected before installation, a contractor digitally tags every pipe and electrical system.

The engineer can view an augmented version of reality through 3D glass recognizes the tags and displays exactly where a misplaced pipe should be relaid via a handheld computer. The 3D cameras recognise the objects and material, and whether they are being at the right place and being with accuracy. The way of measuring distances could become accurate with 'smart fingers'. Currently at the concept stage, two computerized devices fit over the thumb and finger and measure the distance relayed between two points when they are moved apart. The data can be shown on a monitor and transferred via USB to a computer.

The idea of healthy habitat and building involves using the ICT, smart systems and morphotectonic strategies of planning, which enhance public health, hygiene and well-being.

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Automatization never produces results that are 100% reliable

says Alexander Wiechert, CEO Vexcel Imaging in an interview with Coordinates, at the launch of UltraCam Osprey 4.1 large-format aerial camera

Alexander Wiechert
CEO, Vexcel Imaging

Why do you call UltraCam Osprey 4.1 of next generation?

The Osprey 4.1 is represents a completely new UltraCam camera architecture with major new developments in literally all components of the camera system. At Vexcel we innovate constantly. We have launched three camera generations in the past, each with several enhancements. The first generation UltraCam, the UltraCamD, was introduced in 2003. The second generation was launched in 2006 with the UltraCamX and subsequent models such as the UltraCamXp and UltraCamLp. The third generation was released in 2011 with the UltraCam Eagle M1 and has since seen several iterative models, the Eagle M2 and M3, and was also the foundation for new camera designs such as the Osprey M3 or the Condor M1. Now it is again time for a revolutionary jump which brings us to the 4th UltraCam generation with the announcement of the Osprey 4.1, the first model based on this new architecture. This same architecture will be applied to other UltraCammodels, such as the Eagle and Condor, within the next few years. Main aspects of the 4th generation camera architecture are: fully CMOS based cameras, new lenses, new electronics and new camera housing. Collectively, these enhancements result in a new industry standard in efficiency, quality and usability to provide utmost customer benefit.

Despite the ongoing challenges, Vexcel was able to launch Osprey 4.1. How was that made possible?

Well, the development of the Osprey started many, many months ago with research activity that led to development tasks and that now results in a final product. We now are weeks into serial production. So the recent challenges presented by world events affected the whole development cycle for only a short period. We worked closely with our supplier to minimize any effects such as running the camera production in shifts to enable less people in the factory while still maintaining high-volume production. And at Vexcel, we were already very much used to a percentage of the team working remotely, collaborating through video conferencing and so forth, so we already had all the necessary technology in place and employees were already accustomed to using those tools and working in that manner. That enabled us to reorganize the office quickly. The team did a fantastic job here and we were able to maintain a high level of productivity.

How has the prevailing Covid-19 situation affected your work in terms of product development, supply chain etc.?

The impact on the product development was rather minimal, with respect to the software. Generally speaking, software developers are able to work remotely, assuming the technology—such as internet bandwidth and remote connections to the office—are in place. We have retained our development process, our workstreams, and our meeting structure is unchanged though moved to video and teleconferencing. This has worked well with very little additional overhead added. Hardware development, camera

We believe current trends of remote sensing towards higher resolutions, shorter turn-around cycles remain intact and that we will see much more software solutions building on top of the basic data. Challenges could be "cost control" – higher resolution often isn't cheap to achieve.

support and repair are all different. These teams need the office environment. We implemented measures and procedures to ensure a healthy and safe work place for them. Supply chain was, and continues to be, a challenge. Delivery time for components increased and so we increased our inventory significantly to ensure uninterrupted camera production and for support of installed systems.

Could you please highlight role of Vexcel imageries used by various agencies involved in Covid-19 relief measures?

The Vexcel Data Program (VDP) has two elements: "Gray Sky" for natural disaster mapping and "Blue Sky" for continuous mapping. The high-resolution nadir and oblique imagery of the Osprey, in particular, collected under the Blue Sky initiative was used to help in the implementation and organization of Corona measures in cities. Organizations and government agencies such as FEMA used the imagery as basic input for their planning. The imagery made it possible to decide where to put in place aide or temporary hospitals, which streets needed to be blocked to control traffic or pedestrian flow, how to guide people, etc.

Early this year, there was a strategic alliance announced between Vexcel and Verisk, could you please explain briefly what it is all about?

It is all about combining forces in aerial acquisition and imagery production. Vexcel acquired the Imagery Division of Geomni. Geomni is a Verisk company and, among other things, is collecting imagery for the insurance industry just as Vexcel does for our Vexcel Data Program. The merger eliminates redundant data acquisition, combines production forces and merges the existing imagery libraries. The commitment is to drive rapid innovation across imagery and analytics to enter new markets, create new categories, and better serve our customers. The mission is to become the leading global provider of high-resolution oblique and ortho libraries while continuing as the leading provider of highly efficient and accurate commercial mapping systems.

In 2019, Vexcel launched its Data Program in Europe, how successful has the program been? Do you plan any such programs for other parts of the geography?

The Vexcel Data Program has been incredibly successful in the US over the last few years which has led to early flights across Europe, with an initial focus on Germany, in the latter part of 2019. This was a first test that went very well.

The response from our customer base has been overwhelmingly positive and so we have increased our efforts significantly in 2020. We are now using several UltraCam Condors to collect imagery and we plan to soon complete the whole of Western Europe. Additionally, the UltraCam Osprey 4.1 has been launched for flights in Europe, so we are now adding high-resolution nadir and oblique imagery to our European library. Besides Europe, we began collections in Australia already last year and continue flying there. New Zealand is on the 2020 list along with several other APAC countries.

How do you see the growth of photogrammetry and remote sensing going forward? Please highlight few challenges as well.

Photogrammetry as an underlying methodology is only known by, and only visible to, a very small percentage of people in the world. More people talk are familiar with computer vision or analytics, ML, AI, etc. However, photogrammetry will always play an important role as a basic science that enables other technologies to build on top of for meta data extraction, such as analytics.

So we continue to feel strongly about the need for high-resolution, photogrammetric-grade image capture and related camera systems. We believe current trends of remote sensing towards higher resolutions, shorter turn-around cycles remain intact and that we will see much more software solutions building on top of the basic data.

Challenges could be "cost control" – higher resolution often isn't cheap to achieve. Additionally, "quality control" could become a growing challenge. The more we use and rely on automatically-derived metadata, such as analytics results, the more we need to ask ourselves how reliable are the results are that we are using to make decisions. Automatization never produces results that are 100% reliable. How do we ensure that we don't make wrong decisions (or at least minimize the impact of a wrong decision), because we are using information that is incorrect?

Fact 1:

Electronic documents are more powerful and useful due to their ability to link various forms of digital content such as audio, video, and animation, compared to print documents, which are just dead paper.

Electronic documents are much faster to publish. Publishing an electronic document only takes a few seconds, but publishing our advertisements to reach our readers via print magazines can take at least one week.

Electronic documents are much less expensive to publish. Instead of spending thousands of dollars on the cost of print publications, publishing electronic documents costs almost nothing.

Electronic publications have no adverse effects on the environment but print publications require cutting, shipping and processing trees.

Fact 2:

All of the Younger generation (people less than 30 years old) are primarily interested in digital media, electronic documents and internet searches. Even the books that they read are read on tablets and smartphones, meaning that they have little interest or need for print media.

The Middle generation's (people between 30 and 60 years old) focus is split, half on digital media and half on print.

Nearly all of the Older generation depended on print media.

COVID-19 changed many things in a span of few weeks. The COVID-19 virus forced Middle and Older generations to learn how use electronic connections, video conferencing and communicating via computers and smart phones. This is something that we were not able to achieve after many years of promotion.

No more on print media!

JAVAD GNSS will stop advertising in print media and will work towards benefiting from the electronic communication and promotion tools provided by the magazines that we previously used to communicate our message through their print media. They have far reaching e-blast services and electronic messaging.

In addition, we will be working on

- **Audio/Video tutorials**
- **Online publications**
- **Remote Group Video conferences (we have tool for up to 400 participants)**
- **Spreading the news through our sales channels**
- **Local State shows**
- **Words of mouth from happy users**

See us at www.javad.com

TRIUMPH-LS Plus & RTPK

Major good news for surveyors:

PATENTS PENDING

- **TRIUMPH-LS Plus combines RTK and RTPK**
- **RTPK is "Real Time Postprocessed Kinematic" Which can post process the RTK data in parallel and in real time.**
- **RTPK can verify your RTK results in Real Time!**
- **If RTK fails, RTPK comes to rescue in a fraction of a second.**

Price for the current TRIUMPH-LS remains at $12,990 and can be purchased as before.

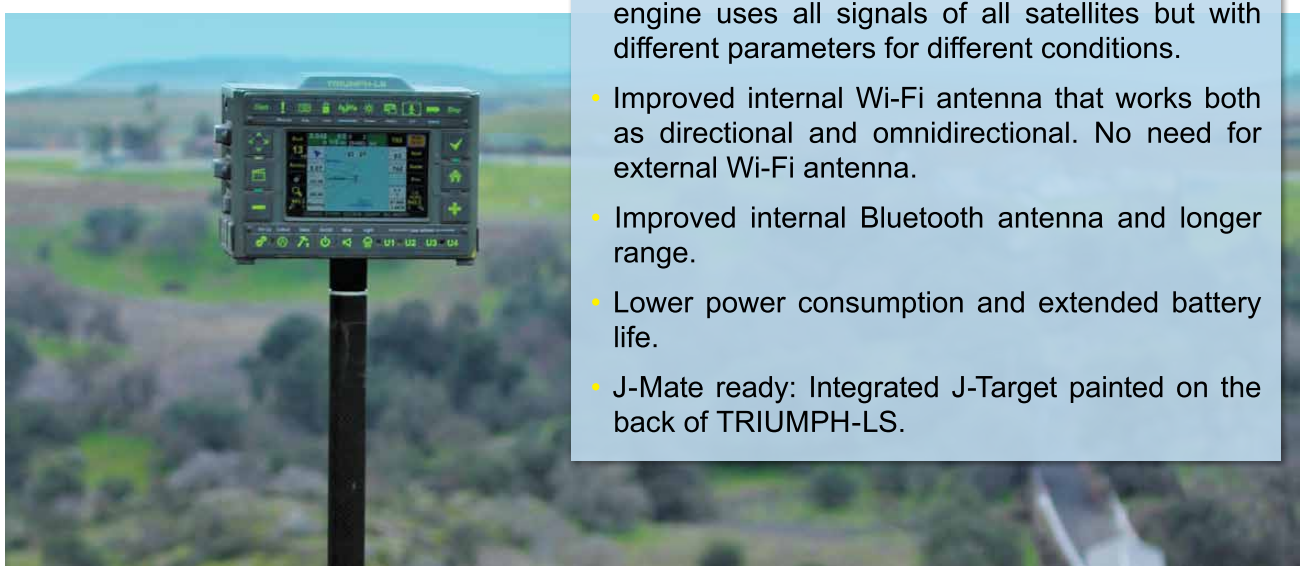
Price of the improved option is $4,990 ($12,990 + $4,990 = $17,980).

Please see our website for additional available options for the TRIUMPH-LS.

Owners of current TRIUMPH-LS units (in working condition) can upgrade their units to the improved option at $5,450 and for $5,700 we will also install a brand new set of batteries.

Option available for the TRIUMPH-LS with the following features, using the new ASIC:

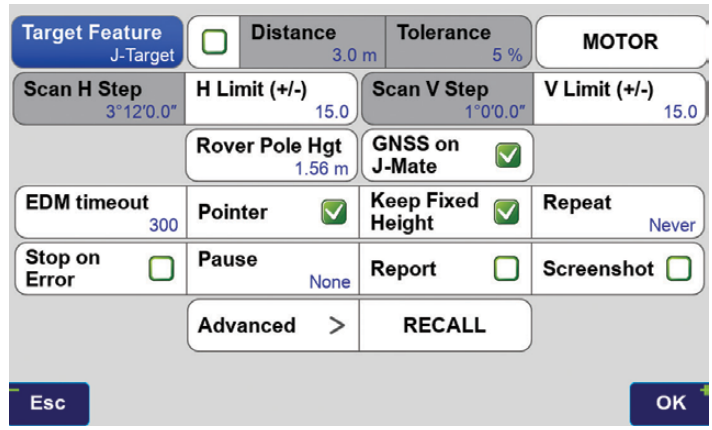
- Improved signal tracking and signal processing (wideband tracking) and adding Galileo and BeiDou L6 bands and Galileo AltBoc and BeiDou AltBoc signals.
- Improved multipath reduction due to wide band tracking.
- Improved spectrum analysis to show and reject spoofers and jammers option.
- Improved RTK with four "Super Engines". Each engine uses all signals of all satellites but with different parameters for different conditions.
- Improved internal Wi-Fi antenna that works both as directional and omnidirectional. No need for external Wi-Fi antenna.
- Improved internal Bluetooth antenna and longer range.
- Lower power consumption and extended battery life.
- J-Mate ready: Integrated J-Target painted on the back of TRIUMPH-LS.



Searching and finding objects by laser and by Optics

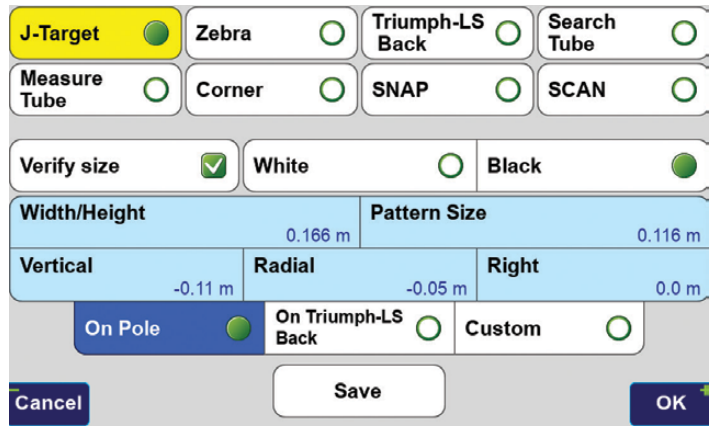
J-Mate has the unique feature of searching for objects by laser and by optics (camera).

Click button  and select “Target Feature” to see the setup screen for target selection and parameters. If you know the approximate distance to the target, click the check box and enter the distance and accuracy percentage. This will help J-Mate to ignore targets that are outside the range.



Horizontal and Vertical Limits are the limits that J-Mate will search around the starting point to find targets.

“Keep Fixed Height” check box, scans horizontally on fixed target height. You may rarely need to use this feature. It will reduce the scanning speed by a factor of 2.



“Laser time limit”

The time that it takes for a laser measurement depends on the reflective surface of the target and weather conditions (dust and moisture in the air).

On a good white reflective surface and in clean air, it takes about 50 milliseconds to have a laser reading. If there is no reflective surface, or the reflective surface is black, it may take up to 4 seconds to have a laser reading.

If the surface of the object that you want to scan is a good reflective surface, limit the laser time to a fraction of a second. This will cause the laser to skip points that do not reflect enough energy in the time limit that you specified. This will significantly increase the scan speed and will ignore points that are not possibly your target and reduces the chance of identifying a wrong object.

Target Features and its offset from the top of the pole are shown in the “Target Features” screen. You can change the parameters by selecting the “Custom” button.

TRIUMPH-LS Back: You can use this feature to search for the back of TRIUMPH-LS and measure to its center to make sure laser range measurement is not from an unintended object.

GNSS Signals in the improved TRIUMPH-LS with the new chip

1130	1140	1150	1160	1170	1180	1190	1200	1210	1220	1230	1240	1250	1260	1270	1280	1290	1300
GPS		L5		A			P2, L2C		B								
GLN					L3		C		CA2, P2		D						
GAL	E5A		E			E5B		F									
	E5-altBOC							G					E6		H		
Bei	B2A		I			B2B		J				B3		K			
	B2-altBOC							L									

1535	1540	1545	1550	1555	1560	1565	1570	1575	1580	1585	1590	1595	1600	1605	1610	1615	1620
GPS			CA, L1C, P1					M									
GLN								CA1, P1					N				
GAL			E1					O									
BEI			B1C					P									
	B1					Q											

GNSS bands for GPS, GLONASS, Galileo and BeiDou signals are depicted in the above figure.

There are total of 22 signals in 17 frequency bands labeled “a” to “q”. Note that GPS C/A, L1C and P1 are in the same band (m) and GLONASS CA/L2 and P2 also are in the same band (d) of the same satellite. In selecting signals for RTK processing, as an option, we may choose to select only one of such signals in the same band. We label this option as “No Same Frequency” option in signal selection strategy screen, discussed later.

GPS				GLN				GAL				BEI			
C/A M	1.0	8	8.0	C/L1 N	1.0	8	8.0	E1 O	1.0	6	6.0	B1C P	1.1	8	8.8
P1 M	0.8	8	6.4	P1 N	1.2	8	9.6	E5B F	1.2	8	9.6	B1 Q	1.0	9	9.0
L2C B	1.0	8	8.0	C/L D	1.0	8	8.0	E5A E	1.2	7	8.4	B2B J	1.2	9	10.8
P2 B	0.8	7	5.6	P2 D	1.2	7	8.4	Eboc G	1.5	6	9.0	B2A H	1.2	8	9.6
L5 A	1.1	5	5.5	L3 C	1.2	2	2.4	E6 H	1.1	8	8.8	Bboc L	1.5	8	12.0
L1C M	1.1	8	8.8									B3 K	1.1	10	11.0

We categorize the GNSS signals as shown in the above figure. The first column is the name of the signal and its designated signal letter (e.g. GPS C/A m). Signals with the same color are those that we discussed earlier as being in the same frequency band of the same system.

The second column is the quality indicator of that signal. Because GPS P1 code, for example, is encrypted and in recovery we lose about 10db of its signal strength we give this signal the quality indicator of 0.8. GLONASS signals also get lower score because of their FDMA signal structure which results in inter-channel biases, even though we reduce such inter-channel biases in our signal processing techniques. Galileo AltBoc and BeiDou AltBoc signals get quality score of 1.5 because of their wide band and signal quality.

The third column is the number of available signals for RTK.

The multiplication of the second and third column is shown in column four, which is an indication of the value of that signal for RTK.

The four super engines

This screenshot shows the four super engine screens. Each engine shows the signals that are used for that engine.

The numbers below each engine are:

- First line is the GDOP of the selected satellites for each engine.
- Second line is the number of signals used / number of signals rejected.
- Third line is epochs since the last reset.
- Fourth line is the solution difference from the first engine.
- Fifth line is the total run time.
- Clicking on each engine, restarts the RTK fix process.
- Long click on each engine to select signals for that engine manually as shown in the figure below.

This screen shows all signals tracked by the TRIUMPH-LS which is real-time indication.

For each system, the name of the signal and its designated signal letter and quality indicator (e.g. GPS C/A M 1.0) are shown. GPS and GLONASS

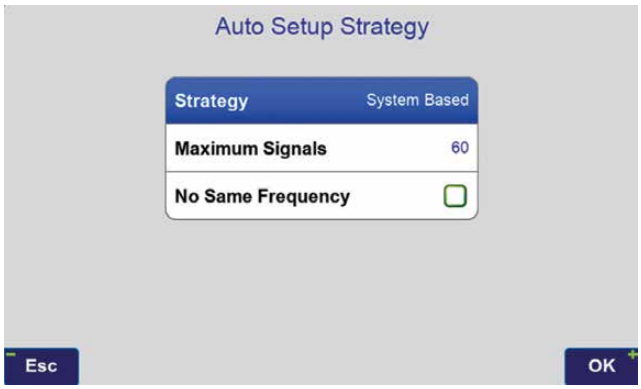
Signals with the same color sideband are those that we discussed earlier as being in the same frequency band of the same system.

Next to the signal name, the top number in each cell is the number of signals tracked by the Rover and the number below that is the number of signals tracked by Base. The smaller number of the two represent the number of common signals between base and rover.

You can long click on the signal name to change the quality indicator of that signal.

Each system is sorted by the number of common signals multiplied by the signal quality indicator.

The number below the signal name is the percentage of noise in that band. Numbers above 30% hint possible spoofing in that band. In case of jamming the original signal and adding a spoofed signal, this percentage may raise to even 200%.



"Auto Setup Engine" button selects signals for each engine automatically according to the strategy option selected by user.

For selection strategy, hold the "Auto Setup Engine" which leads you to the following screen.

"Maximum Signal" box allows you to limit the number of signals used for each engine. Numbers above 60 limits RTK solutions to one per second. Numbers below 30 allows 5 Hz RTK.

The "No Same Frequency" check box selects only one of the GPS and GLONASS signals in the same band as explained earlier.

Click "Strategy" button to select the strategy for automatic signal selections for each engine.

You can long click on each engine and select signals for that engine manually.

In "System based" strategy, for the first engine all GPS signals are used (subject to the check box and Maximum Signal parameters) and then complemented with the best other signals up to the "Maximum Signal" limit. The other three engines are similarly selected by giving preference to GLONASS, Galileo and BeiDou, respectively

In "All the Best" strategy, the best signals among all systems are selected and identical signals are given to the four engines (subject to the Maximum Signal number and the No Same Frequency Check box).

No signal type will be selected unless at least four satellites transmit that signal.

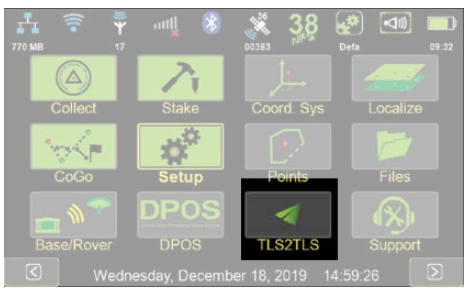
Each engine can accept maximum of 8 signal type. And each signal type can have maximum of 10 signals.

Clicking the "Reset Engines" button, resets all engines.

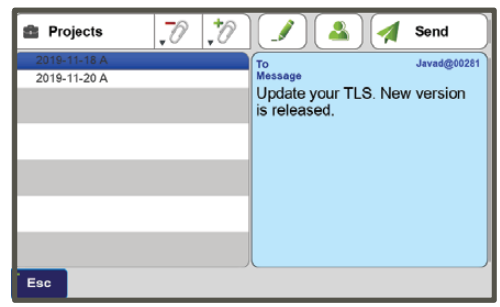
You can switch between "Convention Tracking" and Independent Tracking by clicking on this button. Conventional tracking users information from the L1 band to help other bands.

The number of the bottom right of the Figure 3 is the number of lost data from the base since the last reset. Long click to reset it to zero.

TLS2TLS



You can send and receive text messages and files from and to other TRIUMPH-LS units. In the Main screen click TLS2TLS and then in the "Compose" screen, click and enter names and serial numbers of the TRIUMPH-LS units that you want to communicate with. You can attach Projects, Screenshots, Images, Audio, GNSS RAW files to your text messages and send to the selected TRIUMPH-LS units.

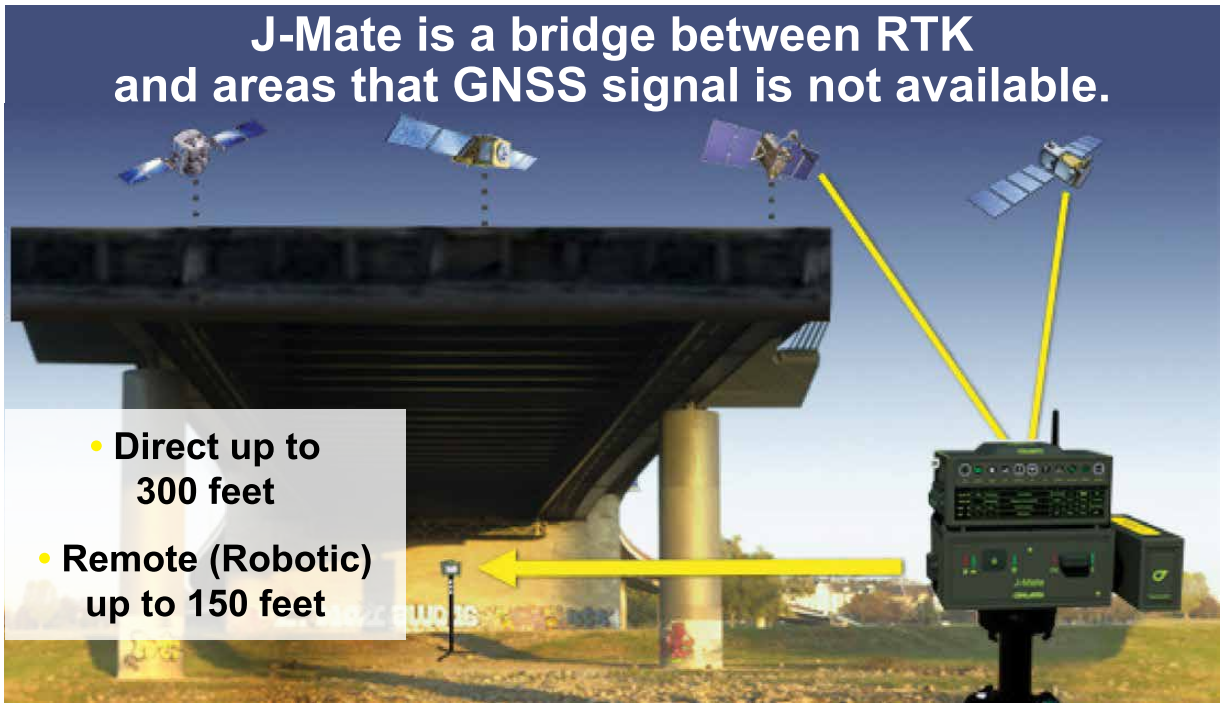


The received messages are shown in the first screen. You can "Import" the attached files, if any, to your local unit. Click "Reply" to reply to a message.

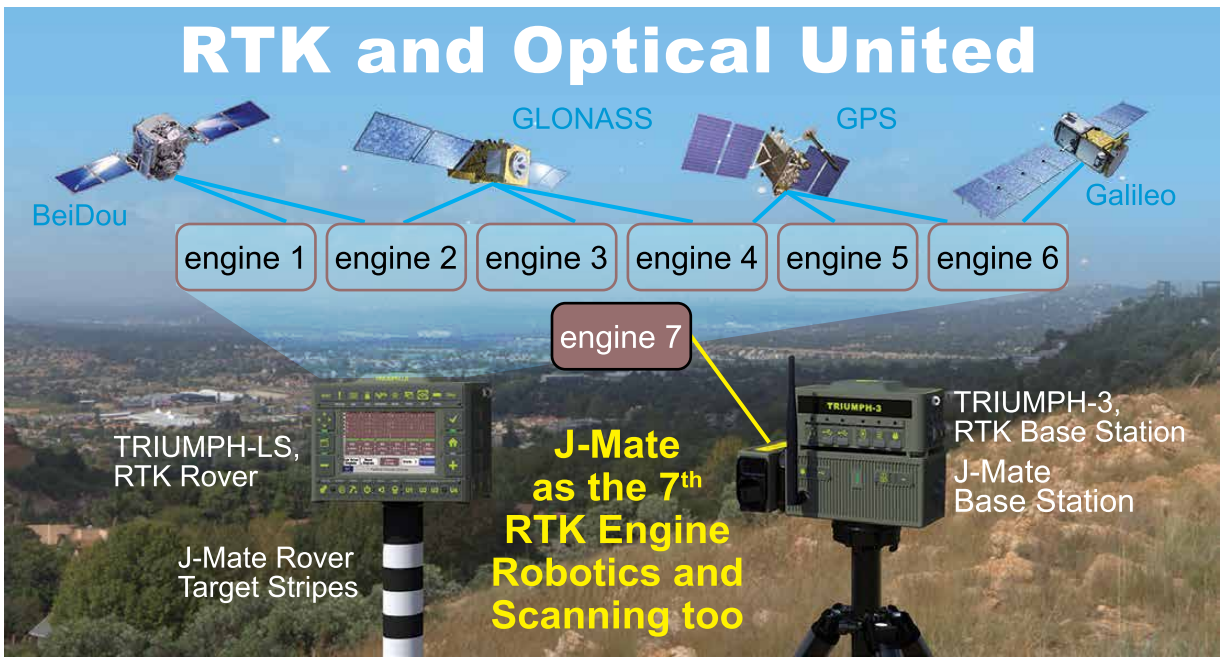
You can reply to received messages by clicking the "Reply" (only to sender) or "ReplyAll" (to all recipients) buttons.

You may receive "Public" messages from JAVAD GNSS team. You do not to reply to them.

J-Mate



J-Mate is not a total-station. J-Mate and TRIUMPH-LS together make the “Total Solution” which is a combination of GNSS, RTK, camera, angle encoders and laser range measurements that together do, conveniently and cost-effectively, a lot more than a total station. For long distances, you use GNSS and for short distances (maximum of 300 feet in Direct mode and 100 feet in Remote/Robotic mode), you use the J-Mate along with the TRIUMPH-LS. Together they provide RTK level accuracy (few centimeters) in ranges from zero to infinity.



TRIUMPH-3

The new TRIUMPH-3 receiver inherits the best features of our famous TRIUMPH-1M.

Based on our new third generation TRIUMPH chip enclosed in a rugged magnesium alloy housing.

The TRIUMPH-3 receiver can operate as a portable base station for Real-time Kinematic (RTK) applications or as a receiver for post-processing, and as a scientific station collecting information for individual studies, such as ionosphere monitoring and the like.

It includes options for all of the software and hardware features required to perform a wide variety of tasks.

- UHF or Spread Spectrum Radio
- 4G/LTE module
- Wi-Fi 5 GHz and 2.4 GHz (802.11 a, b, g, n, d, e, i)
- Dual-mode Bluetooth and Bluetooth LE
- Full-duplex 10BASE-T/100Base-TX Ethernet port
- High Speed USB 2.0 Host (480 Mbps)
- High Speed USB 2.0 Device (480 Mbps)
- High Capacity microSD Card (microSDHC) up to 128GB Class 10;
- “Lift & Tilt”
- J-Mobile interface

Ideal as a base station

Land adminsitration and climate resiliency

How do we administer land in an environment where limitation of land exists yet relocation of communities due to inundation is a must?

Taga Raijeli Lewatu
Ministry of Lands and Mineral Resources, Fiji

Abstract

Fiji has land ownership in Fiji are three different tenureship in state land (4%), native land (90%) and freehold (6%). With 90% of native land ownership, there lies traditional and sentimental ties to the land and its protocols. Exposure to climate change is experienced daily and the nation has voiced the impacts in any platform possible. How do we administer land in an environment where limitation of land exists yet relocation of communities due to inundation is a must? What is development and economic gain in the face of green policies and international best practice? How do we compensate for such traditional values if communities are relocated? To answer these, lands administration in Fiji is working towards digitization using updated technologies to consolidate a national database. State incorporate green policies ideas in work plans such as how mangroves and forest degradation impacts their livelihoods and also their future sustenance. With such climate change experienced, the question for Fiji-where to from here?

Introduction

In Fiji, land administration is guided by the types of land tenure ship that is administrated by State and other agencies. There are three types of land tenure:

- Native land ownership which owns a majority of land in Fiji. These are traditional clans or indigenous Fijians (iTaukeis) owning lands that are administered through the iTaukei Land Trust Board. The composition of this tenure is 91% of lands in Fiji. Most of the local indigenous communities use these parcels for subsistence farming, establishment of villages and other communal activities they think is best for them.
- State lands are land parcels owned and administered by State for identified purposes. This comprise of <4 % of total lands in Fiji. These parcels were taken initially by State for nation building and development. Some are classified as Crown Grants, Crown Freeholds, Native Lease to State and State Lease etc. However these lands were initially owned by native indigenous communities before the colonists entered Fiji and tried to establish a Western type government for which these lands were given.
- Freehold Lands-these are usually privately owned by Fijians that have outright authority over their property.

In trying to combat climate changes, land administration or development strategies should account for land loss through sea level rise, vulnerability to food inundation, loss of fertile agricultural land and most importantly consideration for best practices to combat climate changes.

In the United Nations publication of 1996, Land Administration Guidelines, the main focus was to outline the benefit of having a reliable and relevant land information system. With the growing population, half of humanity now lives in cities and towns and by the middle of this century 70 % of the world's population will live in urban areas (2012).

Fiji with its landmass of 18, 272 km^2 and approximately houses 57 % urban

centers it is imperative that Fiji reviews its land administration system to ensure its vibrancy in a changing climate (2019) .

Objectives

This paper provides information on how land administration has been impacted by natural climatic changes that challenges the cornerstone of development economically and socially.

Background

Fiji recently is progressing its Climate Change Bill which will guide the legal mandate of government in terms of ensuring resiliency. Together with this, the National Disaster Risk Reduction Policy was endorsed which will be implemented in trying to achieve the targets of the Nation's Development Plan.

According to a World Bank country assessment (NDDR 2018-2030), it was noted that:

- Fiji has an inherently high potential of exposure to an array of natural disaster;
- Fiji is also vulnerable to human induced and technological disasters;
- One of the contributing factors to its vulnerability is poorly planned land use and development and poor infrastructure; and
- Lack of preparedness in terms of disaster awareness.

In progressing Fiji's resilience to climate change and other socio-economic disasters, a fundamental progress needs to be seen with land administration processes.

Land administration

In Fiji the absence of preplanning and strategies have contributed to an increase in population in peri-urban and urban centers; conversion of prime agricultural land for commercial ventures and lack of land use planning. All these contribute to informal settlements; erosion; ocean and waterways pollution; increase in flooding and landslides.

There are a number of government agencies that work in coordination in the leasing of state land. They each make their technical expert advice to enable the lease to be issued. They make assessments on types of land use; zonation; environmental impacts and boundary definition. There is a clear need for the development in these areas as Fiji tries to build climate change resilience and also ensure food security and livelihoods for its people.

Disaster impacts

In 2016, a Category 5 cyclone struck Fiji which affected 60% of the nation's population. Widespread damage could be seen with infrastructure, agricultural lands, health and education facilities and approximately more than 40000 houses destroyed. Such fierce cyclones, floods and bushfires are predicted with climatic changes affecting the world.

Fiji as a signatory to the Sendai Framework, has used the data post disaster to boost its campaign to launch the National Disaster Risk Reduction Policy in 2020. This policy aims to enable the nation Fiji to deliver on its priority of preventing new disaster risk and reducing existing disaster risk in line with relevant regional and global frameworks.

Disasters in Fiji are categorized in to 3 (I, II and III) with specific levels of targets hazards and disasters.This will also assist is planning strategic post disaster approaches and economic impacts.

Types of disasters

During floods and heavy rainfall, agricultural lands are affected together with residential communities near waterways such as creeks and rivers. Landslips are now frequent due to the changes in climatic or weather patterns which favor such hazards. Therefore, for any land allocated for any form of land use, determination of ground stability is now a criterion.

Current processes

Statutory framework

The state administers State lands within the ambit of the State Lands Act of 1945. The law determines the ambit within which state lands should be administered with the assistance of other laws such as the River and Streams Act (1880), Land Use Act (2010), Land Sales act (1974), Land Transfer Act (1971), Surveyors Act (1969) and the Property Law Act (1971).

These laws were formulated ages ago and have not anticipated the drastic changes these climatic conditions would impact state lands and land use. Development has progressed over the years and these laws have remained without review to address the modern changes.

In administering lands processes there are also other associated laws that assist or need to be considered. A few of these are the Environment Management Act (2005), Mining Act (1965),I Taukei Lands Act (1905), Forest Act (1992).

Table 1: Damage and Losses for Tropical Cyclones 2010-2019
Source: NDMO reports

Cyclone	Year	Damages &Losses ($FJ)	% of GDP	Casualties
Tomas	2010	$84,326,800.49	1.8	1
Evans	2012	$194,960,796	3.34	0
Winston	2016	$1,999,000,000	20.32	44
Gita	2018	$1,273,471	0.012	0
Josie	2018	N/A	N/A	7
Kini	2018	$31,943,748.13	0.29	1
Sarai	2019	TBC	TBC	2
Total		$2,311,504,815.62	3.20	55

In process now are two important policies namely the Climate Change Bill and Oceans Policy which will affect foreshore lands management and mangrove plantations conservation efforts.

State initiatives

There are a few state initiatives or supported programs which also impacts lands administration. These are REDD+; planting of 4 million trees in 4 years; digitization of the government information and processes; formulation of the mangrove management plan and other international dialogue that would promote environment conservation and sustainable development.

Lands administration processes

The allocation of state land follows an approved process that is mandated by the relevant laws. Valuation and inspection are undertaken and all contributing factors are considered before survey and leasing of land is approved.

However, the department of lands now does employ modern technologies for assessments and surveys such as using drones and geospatial information analysis to asset in such land developments.

To ensure ground structural; stability, geo-technical survey is being required to inform the state if locations are suitable for the land use form that is to be assigned.

Environment assessments which have its own laws and processes are now given importance to ensure that tenants or landowners are informed correctly on the impacts of climate change on their piece of land. Zoning of the areas as in town planning plans are also considered to allow for sustainable yet coordinated development to be undertaken.

Also there is allowance for the land bank processes where native lands are acquired by the state, deposited in a land bank for economic developments or initiatives.

Fiji is undertaking its Agricultural Census and Forestry is also embarking on taking stock of all forests in Fiji. These are initiatives of government ensuring that projects undertaken by state are environmentally sustainable and climate smart.

Results

In the last decade, Fiji has realized the adverse impacts climate change will bring to the country with its island setting and wide oceans surrounding.

The national development plans started to gradually incorporate climate change adaptation measures which are now implemented and part of the nation's strategies.

Fiji is not resource rich but is land rich in the sense that 91% of lands in Fiji are owned by indigenous landowners or iTaukeis. Only 3-4 % of Fiji lands belong to the state with the balance titled freehold lands. Most of the developments in after disasters and most likely in future will need land that is acquired from these landowners.

Mostly government needs or projects for national purposes are prioritized whereby state acquires the land through the department of lands. Such are government stations in the rural areas, water or electricity facilities, roads, hospitals and public areas such as sporting grounds.

The use of new information and modern technologies has improved the:

- Timelines in processing of leases
- Accounted for environment degradation
- Driven the formulation of necessary legislations and action plans
- Facilitated in the establishment of resource surveys and the relevant auditing or monitoring structures
- Adherence to global programs and developments
- Increasing of an awareness within the country of impacts of climate change and importance of national readiness
- Diversifying of focus on land administation to be incorporate other relevant factors such land use information, town planning criteria and environment management strategies.

Climate resilience

What is resilience? According to the definition in the Oxford Dictionary, it is the ability or the capacity to recover quickly from difficulties; the toughness or elasticity of a substance. In the context of this paper, climate resilience can be defined as the capacity for a socio-ecological system to:

- absorb stresses and maintain function in the face of external stresses imposed upon it by climate change;
- adapt, reorganise and evolve into more desirable configurations that improve the sustainability of the system, leaving it better prepared for future climate change impacts (Folke, 2006).
- Climatic changes could be used as opportunities to improve systems or innovate and evolve into new systems. Resilience includes adaption but more so of the ecological systems to improve in absorbing changes but reconfigure itself to develop into a more efficient configuration (Nelson, Adger, & Brown, 2007) . Discussions on these issues including vulnerability cannot be made in isolation as smaller countries especially in the Pacific have discovered. It has to be taken into totality so as to drive the efforts dedicated in building resilient communities in the Pacific.

Currently in the Pacific, the socio-ecological systems no longer operate under the assumption that if any changes occur, the system will involuntarily work towards an equilibrium or stable point. In this age of vulnerability, changes are harnessed to provide new baseline of operations. This drove the changes that the Pacific Island Countries are advocating for the facilitation of changes in adaptive management and environmental resources (Tompkins & Adger, 2004).

In the PICs, livelihoods are entrenched in the natural ecosystems that surround their lives and if any one of such ecosystems

is affected, it provides a domino effect in that it attacks the foundation of all. Therefore PICs are using the platform of climate resilience to address global warming issues and sea level rise impacts.

The local scenario–Fiji

In Fiji, the changes in the weather patterns, in terms of temperatures, flash flooding from heavy rainfalls, sea level rise and many others are becoming resoundingly loud making the country a mouthpiece for all PICs in campaigning for the reduction of carbon emission. Fiji as was announced by the Prime Minister, Mr. Voreqe Bainimarama at the recent Special Session on Urban Culture and Climate Change Action in Abu Dhabi, is driving towards being carbon neutral by 2050 (2020).

The state has now tried to incorporate these new pathways into its lands administration processes. Some of the changes it is embarking on implementing are:

- Digitisation of land information – for leasing and property ownership the nation is trying to reduce the amount of paper that is used. This reduces fuels costs as well in terms of electricity, man-hours, office space and ultimately will reduce time for processing. This enhances coordination between they state agencies and stakeholders, introduces a more transparent system and more access to information which may lead to critical decisions being made efficiently.
- Use of technology in mapping and survey works-state has begun employing drones or unmanned aerial vehicle to monitor its leases utilization, boundary definitions and also to assist in compensation discussions. These technology in using Remote Sensing and GIS has facilitated the production of better maps and also consolidation of all information pertaining land development making it easier for decision and policy makers to determine direction for national development.
- Introduction of environmental impact assessments and climate smart innovations in administration processes thus creating a holistic approach in endorsing land use types for state lands. With its EMA (2005) legislation, any development that will cause a disturbance to the natural environment requires and EIA which will consider any mitigation measure that the developer may employ.
- The education and awareness created in the people to appreciate the statues of our environment and partner with the government in trying to curb the fast growing changes brought about these climate changes.
- Formulation of relevant policies such as the Mangrove Management Plan, Climate Change Bill, Fair Share Act, Ocean's Policy, National Climate Change Policy, National Distaster Reduction Policy and also Fiji's National Adaptation Plan Framework. This is in addition to efforts by each agency of government to formulate policies relevant to its targeted plans. Through these platforms of advocacy, a 5 and 20 years National Development Plan was compiled where each responsible agency whether private or state (including state owned enterprises) are given targets to achieve. This has clarified and defined the work to be done and minimizes losses and wastage.
- At the grass root level, adaption efforts has taken many forms ranging from sea-wall and flood defenses construction, setting up of early warning systems as in earthquakes and tsunamis, groundwater development for drought stricken agricultural lands and reinforcement designs for areas vulnerable to landslips. These are changes made with the coordination and contribution of the lands department in the effort of building resilient communities.
- The Government of Fiji also has comprehensive disaster recovery programs that assist affected households in recovering from the impacts of disasters. In addition to sectorial rehabilitation programs, the Government following Tropical Cyclone Winston introduced the Cyclone Assistance Relief Effort (CARE) program to enable the public to return as quickly as possible to normalcy.

Table 2: Government of Fiji Cyclone Assistance Relief Effort (CARE) Programs

No.	Program	Government Assistance for Affected Households
1	Homes CARE	Funds to repair partially damaged or totally destroyed homes
2	Farm CARE	Provision of seeds, debris removal, livestock feed, fencing
3	Sugarcane CARE	Fertilizer assistance, clearing of drainage and waterways, debris removal
4	Welfare CARE	Extra one month top-up for existing welfare recipients
5	E Transport CARE	$50 top-up for bus cards
6	Leaseholders CARE	Payment of 1 years lease for residential and agricultural leases

Source: Ministry of Economy

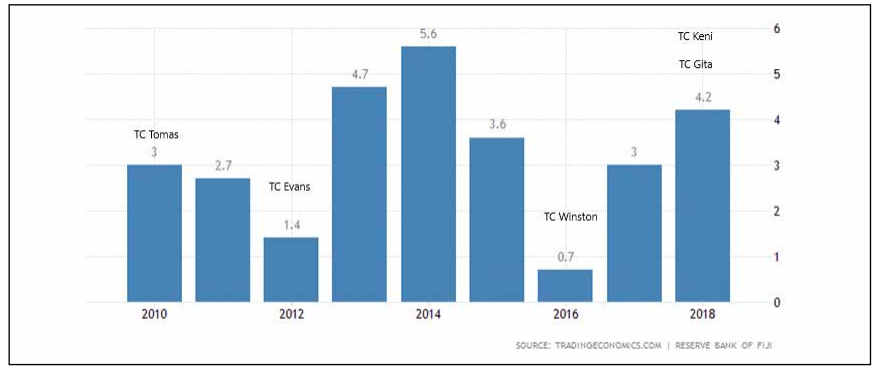


Figure 1: Impact of Tropical Cyclones on GDP Growth 2010–2018

The state continued to support the people in Building Resilient Communities and Build Better People efforts to ensure that the nation is prepared for future disasters.

Landslides

A record of 100 landslide events occurred since TC Winston and these were surveyed and mitigation strategies were recommended for recovery where home destructions occurred and lives lost.

These landslides usually occurred during heavy rainfall and cause road blockages, destruction of infrastructures, river bank collapses and at times loss of human lives.

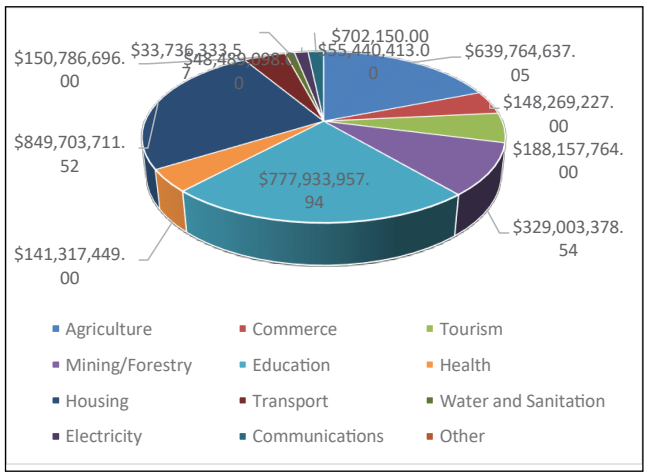


Figure 2: Sectorial Damages for Cyclones 2010-2018

Table 3: Rehabilitation Costs for Tropical Cyclones 2010-2018

Cyclone	Year	Rehabilitation Cost	Percentage of GDP
Tomas	2010	$11,505,167.84	0.23
Evans	2012	$144,011,2866	24.74
Winston	2016	$1,957,800,000	19.9
Gita	2018	$1,995,622.30	0.018
Total		**$3,411,413,656.14**	**10.93**

Source: NDMO reports

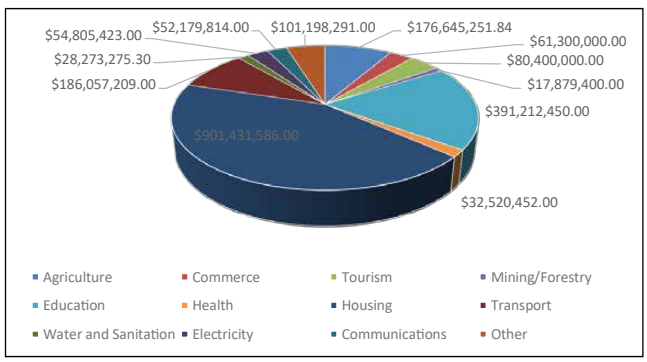


Figure 3: Sectorial Reconstruction and Rehabilitation Costs 2010-2018
Source: NDMO reports

The goals of land policies vary but most will include poverty reduction, sustainable agriculture, and sustainable communities for human settlers, equity and economic development. But what do we do with the pressing issues of relocation, inundation, loss of land fertility, sea level rise all which are brought on by climate change?

The state now requires a geotechnical assessment determining the stability of the ground to be made by developers prior to any development commences.

Also the construction sector has now revised the building codes to implement practices that will ensure infrastructure built in future will be able to withstand Category 5 Cyclones and also major earthquakes.

Earthquakes

There has been more than a 1000 events that have been detected locally and also regionally. Recently there was felt tremors on the island of Kadavu which caused massive cracks and landslides of the highest peak of Mt. Washington.

Conclusion

The goals of land policies vary but most will include poverty reduction, sustainable agriculture, and sustainable communities for human settlers, equity and economic development. But what do we do with the pressing issues of relocation, inundation, loss of land fertility, sea level rise all which are brought on by climate change?

In conclusion, this paper is to establish the context of the need to modernize land administration in vulnerable nations such as the PICs to ensure that people have security of tenure as well as safe livelihoods in the increasing impacts of climate change. Evidence as shown in this paper demonstrates include that the strengths of cyclones have increased, earthquakes and tremors are more frequent, and landslides due to long dry seasons followed by high rainfalls are more. The economic loss challenges these developing nations yet there is determination to soften the blows from these disasters and build better and stronger infrastructure and also resilient communities.

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The paper was prepared for presentation at the "2020 World Bank conference on Land and Poverty " The World Bank - Washington DC, March 16-20, 2020.

4 Earth Intelligence publishes heat hazard data

Earth observation company 4 Earth Intelligence has used satellites to create the UK's first street level map of 'at risk' areas to help plan for and manage the effects of extreme weather conditions. With support from the Ordnance Survey through their Covid-19 Response licensing, the Heat Hazard Postcode data is being made available free at the point of use to national organisations and multi-agency partnerships, such as Local Resilience Forums, that are currently battling the coronavirus pandemic.

Derived from satellite imagery and created using automated algorithms, the data identifies hot spots within urban areas where temperatures are generally higher forming an Urban Heat Island. With above average temperatures forecasted, and the summer of 2020 already being predicted as one of the hottest on record, it is feared that this could severely impact on already stretched public resources. It is estimated that the heat waves of 2019 led to almost 900 extra deaths in England and it is possible, that if the general population is still in lockdown, that the figures for 2020 could be higher.

Research funded by the Department of Health in the UK indicates that over 7,000 people could die from the effects of urban heat waves per year by the 2050s. The UHI effect can also impact air and water quality, and demands for energy, with implications for carbon neutral targets, public health, strategic planning and city resilience. *www.4earthintelligence.com*

Remote sensing to keep 'TRAC' of farming

As part of the regulated farming system to be followed from the coming crop season in Telangana, India details of crops cultivated would be enumerated completely with the help of remote sensing(RS) applications, which would enable the officials to list exact cultivation details of every crop since it had the ability to identify the extent of cultivation survey number-wise and crop-wise based on colours of crops.

By linking the RS applications with crop cutting experiments, estimation of crop yield and production could also be known with 95% reliability. The exercise to link agriculture in Telangana with TRAC had already been set in motion as part of implementation of the comprehensive agriculture policy. *www.thehindu.com*

Chinese researchers quantify water clarity with remote sensing data

Chinese researchers have mapped the country's water clarity of lakes and reservoirs in 30-meter resolution using remote sensing imagery data.

Water clarity is a reliable indicator for quantifying eutrophic status, said their recently published research article in journal Remote Sensing of Environment. The researchers from the Northeast Institute of Geography and Agroecology of the Chinese Academy of Sciences collected 2,152 samples from 34 field campaigns from 2013 to 2018.

Based on both measured data and Landsat OLI remote sensing data, they developed regression models to map water clarity with a 30-meter resolution at a national scale. The research showed that the lakes in northeastern and eastern China had low clarity due to shallow water depth combined with high suspended matter and algal abundance.

Lakes in the Yunnan-Guizhou Plateau, Inner Mongolia Autonomous Region and Xinjiang Uygur Autonomous Region exhibited intermediate clarity, while lakes in the Qinghai-Tibet Plateau displayed the highest clarity, according to the article.

The Landsat imagery was demonstrated to be applicable in providing quantitative information about lake water clarity.

The research is expected to support inland water management and improve water quality. *www.xinhuanet.com*

NSDI - Moving from 'data' to 'application' domain with continuously evolving Geo-ICT

says PS Acharya, CEO, National Spatial Data Infrastructure(NSDI), Department of Science & Technology, Government of India shares the status, activities and future plans of NSDI in India in an interview with Coordinates magazine

PS Acharya
CEO, National Spatial Data Infrastructure (NSDI), Department of Science & Technology, Government of India

What is the status of NSDI?

Over the years, NSDI has been successful in providing a nation-wide coordinating framework for sharing of standards-based geospatial data services at the Central and State/ Union Territory (UT) Government levels. A group of 12 Central and 18 State/ UT Government Agencies have been enrolled in the process of developing and maintaining geo-portals, framing data sharing and accessibility policies; and adopting national geospatial data and service standards in the provision of interoperable map/ data services. NSDI is currently poised towards provision of registry/ catalogue services and application services.

What are its main activities?

Main activities include framing supportive policies, maintenance of Standards-based Data service Nodes; operationalising registry/ catalogue services; setting up a data processing platform for provision of integrated geospatial information; coordinated preparation and maintenance of high resolution foundation data; formulation of national standards; pursuing related Research & Development for sustaining NSDI and providing state-of-art analytics; building interface with activities of international bodies like Open Geospatial Consortium (OGC), International Standardisation Organisation (ISO), and United Nations Global Geospatial Information Management (UN GGIM); and building capacity of providers and consumers.

One of the focuses of the NSDI is to establish National Data Registry (NDR). What is purpose of the NDR?

NDR seeks to provide a standards-based on-line catalogue for registration, search and discovery of geospatial data provided by various Data Providing Agencies/ Line Departments at Central/ State/ UT Government Levels, Academic Institutions; Private Enterprises; and NGOs/CSOs. With standards-based map/ feature/ attribute data services getting increasingly accessible from Data Nodes/ Geo-portals of various Agencies, there is a need for identifying and keeping track of these services with the help of a catalogue so that those could be optimally utilized in developing GIS applications/ solutions. Procedures for registration of geospatial data using ISO19135 has been adopted.

Does NDR need any legislative backing also?

Registering, publishing, and sharing geospatial data sets through the NDR is proposed to be made mandatory that is expected to prevent duplication of data acquisition thereby minimizing the cost of the data infrastructure and promote multi-domain data integration. All the communities of stakeholders

Absence of a more effective institutional framework for standards-based data registration and sharing, non-availability of efficient data life-cycle management mechanism are some of the key challenges faced by NSDI

including providers and consumers are expected to benefit. Stakeholders may need to comply with a set of directives on registration, standardization; and publication of geospatial data unto the NDR with the backing of a suitable legislation in order for the NDR mechanism to work effectively.

What is the progress on data standardisation? We understand Bureau of Indian Standards (BIS) is also playing a role? What is their role?

Substantial progress has been made in institutionalizing standards-making in the domain of geospatial data and processes, framing and adopting geospatial data and process standards in implementing NSDI and State Spatial Data Infrastructures (SSDIs) towards achieving interoperability. Geospatial metadata and data content standards have been framed by NSDI and are being adopted by BIS as national standards. A series of international standards from the OGC and the ISO have been tested on Indian data sets/ services and co-branded as national standards by the BIS for standards-based open sharing of and access to geospatial data.

One of the objectives of the NSDI in India was to provide a single window access to all users of spatial data using state of the art technologies? How close we are to this objective?

NSDI has been quite close to this objective. Organizational Data Nodes of various Partnering Agencies from Central/ State Governments have been operational and increasingly making data sets sharable/ accessible as standards-based map or feature data services. Under the NDR activities, feature data services of a set of 6 Agencies over the past months have been made accessible with geospatial and registry-related metadata sets through a single-window access mechanism for developing processing/ querying services. In the coming phase, all the data sets for the entire country and all the States/ UTs are proposed to be registered in the NDR for addressing user queries and providing application/ solution services.

What is the progress on State SDIs?

State SDI Data Nodes have been set up or are in the process of getting established in 15 States and 3 Union Territories (including the National Capital Territory of Delhi). Standards-based map/ feature data services and applications have been made accessible from the Data Nodes and are being used by State/ UT Level Line Departments. Some States/ UTs like Odisha, Madhya Pradesh, Delhi and J&K have shared map/ feature data services with concerned Line Departments for managing the COVID-19 outbreak and deploying related application services. States/ UTs uncovered so far have been requested to set up Data Nodes and register the data services in the NDR to facilitate their utilisation.

Are you using cloud platform?

Yes, a proof-of-concept Geospatial Cloud-based platform has been implemented at SOI, Hyderabad. The platform is being tested for life cycle management of high resolution geospatial data sets, quicker on-boarding of geospatial data/ application/ solution services; and developing benchmarks for designing operational scale geospatial platforms for the provision of web-based application services.

Any focus on R&D?

Continuously evolving Geo-information & Communication Technologies (Geo-ICT) have been a critical component of NSDI and thus R&D activities receive due attention. Some of the priority areas being pursued under NSDI include Indoor Positioning, Modelling & Navigation; Spatio-temporal Data Analytics; Interoperability and Integration of Information; Cloud Computing; Ontologies; Deep/ Machine Learning & AI; Block Chain and Distributed Ledger Technologies; New Data Sources and Collection Technologies; Autonomous Spatial Data Platforms etc.

What about capacity building?

Demonstration, sensitization and training have been the key components of NSDI and State SDIs. Capacity building through such activities not only helps in building the infrastructure but also in utilizing the web-based data services from the data nodes in GIS packages and utilities. About 9 such end user demonstration workshops/ training courses have been conducted over the past year in different parts of the country. An additional 10 events are proposed for the current year.

Can you list the achievements of the NSDI?

A major achievement of NSDI has been the establishment and sustenance of the NSDI mechanism for coordinated management of geo-data nationwide. Stakeholders have been enrolled and enabled over the years leading to availability of teams of trained staff/ experts on use of geo-data standards for interoperability and geospatial contract management in National/ State Agencies. NSDI and State SDI Data Nodes/ Portals have been operationalised for improving accessibility to standards-based data and metadata services by the end users. Geo-Information standards-making has been institutionalized through the LITD-22 Sectional Committee of the Bureau of Indian Standards (BIS). Data Sharing & Accessibility Policies have been framed and adopted at the National and State Levels for providing the requisite governance framework for data management by stakeholder agencies. The National Data Portal (https://data.gov.in) of the National Informatics Centre (NIC) has been a direct outcome of the National Data Sharing & Accessibility Policy (NDSAP). As mentioned above,

NDR and a proof-of-concept Geospatial Cloud Platform-based Data Centre have been established recently for operational access. Development of training material on SDIs and provision of technical support to building SDI Data Nodes have been made possible with a core group of experts and skills now available in the country.

What are the key challenges?

Absence of a more effective institutional framework for standards-based data registration and sharing, non-availability of efficient data life-cycle management mechanism and processes in various Data Providing Agencies and Line Departments; non-availability of consistent, seamless, authoritative high resolution foundation data; inadequate human resource and capacity in various Agencies and the Industry to develop, maintain, and utilise standards-based data nodes are some of the key challenges faced by NSDI.

What is your road map for the NSDI?

Efforts are being made to overcome the above challenges in the short and medium terms towards providing a state-of-the-art Geospatial Information Application Infrastructure for governance and decision-making. This will be achieved, amongst others, by upgrading the NDR and establishing a right-sized platform for geospatial data processing for providing product/ application/ solution services on-line with the involvement of Industry, Academia and the Civil Society Organisations (CSOs) for re-growth of the economy in post COVID-19 scenario. Satndard specifications from OGC/ ISO/ BIS and guidelines/ best practice documents from UNGGIM are expected to help the country build a world-class and state-of-art Application Infrastructure for supporting the development of the New India by 2022-23 by making the evidence-based policy-making integral to the governance structure of the country.

iQSTEL's adds GSM Network and GPS Tracking Support

iQSTEL Inc. has announced that its subsidiary IoT Labs MX has completed the circuit board upgrades for the new generation of the IoT (Internet of Things) Smart Gas field devices.

The original IoT Smart Gas platform was limited to the Sigfox communications infrastructure for IoT devices. Our in-house development team has completed the communications board upgrade for the new generation of IoT Smart Gas field devices, allowing for GSM network communications, expanding the potential usage locations of the IoT Smart Gas platform. In addition, we have incorporated Geo-location using standard GPS systems. *www.iQSTEL.com*

eSAT Global for tracking endangered species

eSAT Global, Inc. ("eSAT") a developer of low cost, real-time satellite IoT connectivity solutions has announced its partnership with IoT device company G8Way Technologies. It has developed a host of sensor solutions which have been implemented in a range of applications from high value asset tracking, animal traceability, cold chain and other security related solutions in South Africa. It has been playing an active role in the counter poaching movement, helping to protect and preserve endangered wildlife. *www.esatglobal.com*

Radar technology for short-range detection

The German radar technology company InnoSenT is launching a new product for building and security technology. It is the first commercial 24GHz FMCW radar system with advanced MIMO radar technology and integrated signal processing for short-range detection. The iSYS-5005 offers innovative features for optimal performance: The Doppler sensor is equipped with complex signal processing and 3D radar resolution. This achieves outstanding reliability and accuracy in object detection.

The resolution over the measuring dimensions distance, speed and angle allows exact localization (X and Y coordinates) and object separation. The wide opening angle (± 75 ° in azimuth / ± 30 ° in elevation) maximizes the detection area. The detection range is up to 15 meters. *www.innosent.de*

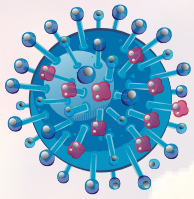
APCOA and HERE partnership

APCOA PARKING and HERE Technologies have announced plans for a strategic technology and commercial partnership. Both companies intend to develop and commercialize digital parking services and HD indoor maps of parking facilities in Europe. To this end, they plan to combine their complementary capabilities in parking and mapping to jointly pursue business opportunities in the automotive and urban mobility sectors. *www.apcoa.com*

iDriverplus selects Ouster Lidar

Ouster, Inc., a leading provider of high-resolution lidar sensors for autonomous vehicles, robotics, security, and mapping, has announced a partnership with Chinese robotics leader iDriverplus for autonomous cleaning and sanitation robots used to safely sanitize and disinfect potentially contaminated sidewalks and public areas.

In February, after China entered into a state of emergency due to COVID-19, iDriverplus and Ouster partnered to outfit a fleet of robots with OS1-64 lidar sensors to help contain the virus. The unmanned cleaning and disinfection vehicles were equipped with OS1-64 lidar sensors on the top and the front of the vehicle, providing higher resolution 360-degree 3D environmental monitoring and more accurate front obstacle recognition than was possible with legacy 16-channel analog lidar sensors. *ouster.com*

Tracking C  VID

Tracking COVID-19 with Big Data, GIS and Social Media

Ming-Hsiang Tsou, director of The Center for Human Dynamics in the Mobile Age (HDMA) at San Diego State University, and his team developed the hub to serve as a single source of information given the large amount of COVID-19-related data available. The Research HUB offers six areas of collected data, including vulnerability maps and San Diego ZIP code maps. It also includes timelines about major policies and events for 16 major cities. Webinars, videos and slides which utilize national research data along with SMART dashboards that use social media and keywords to monitor real-time information are included in the Research HUB.

The HDMA group applied both data science tools (visual analytics) and data visualization methods (maps) to enable the dashboard visualizations. The "Vulnerability Map," created by third-year geography/GIS student Jessica Embury, visualizes and maps diabetes-related emergency department discharge information by age and location in San Diego County with data provided by HHSA. *https://newscenter.sdsu.edu*

NASA funds four research projects on COVID-19 impacts

NASA's Earth Science Division is supporting the science community as it investigates the many changes this unique situation has brought to light. Through its Rapid Response and Novel Research in Earth Science (RRNES) initiative, the agency is providing funding for selected, rapid-turnaround projects that make innovative use of satellite data and other NASA resources to address the different environmental, economic and societal impacts of the pandemic. NASA announced last month the first RRNES projects and is continuing to evaluate new project proposals.

The agency recently funded the following four RRNES projects:

- Exploring uneven gains in urban air quality
- Impact of air pollution reduction on the atmosphere
- Air pollution links to water quality
- Shedding (night) light on pandemic economic impacts

www.nasa.gov

Vodafone UK launches IoT heat sensor to help coronavirus fight

The camera has been developed in partnership with Digital Barriers, can apparently screen the body temperature of 100 people per minute and claims to be accurate to within around half a degree Celsius. One of the main symptoms of coronavirus infection is an increased body temperature, so this sort of technology is being seriously considered as a relatively efficient way of screening large numbers of people. *https://telecoms.com*

Disaster Tech & Kinetica launches crisis management platform

Kinetica and Disaster Tech announced the release of the COVID-19 Real-time Crisis Management Platform to aggregate and track data relevant to COVID-19 emergency response. The platform is able to combine current data, such as hospital capacity and diversion status, locations of alternative medical sites, state-wide declarations, testing kit quantities, and protective equipment availability at a local level, for example. The platform functionality is the direct result of a survey of emergency managers and emergency responders across disciplines, and blends data from 30 different government, public health, and private sector sources.

Disaster Tech is a public benefit corporation that builds technology to analyze, visualize, and communicate risk, on a mission to accelerate decision-making to save lives, protect the environment, and reduce risk to communities and critical infrastructure. *www.disastertech.com*

India's Aarogya Setu app is now open source

The Government of India has made the android version of Aarogya setu app open source. The app designed for tracking COVID-19 cases was facing several questions regarding users privacy and security. Making it open source will allow developers to inspect the source code of the app and modify for changes. The source code of the Android version is already available for review and collaboration. Developers and researchers can visit https://github.com/nic-delhi/AarogyaSetu_Android.git link to participate. The app uses Bluetooth and location data to function. It has advised more than 900,000 users to quarantine themselves or get tested for the disease and almost 24% of them have confirmed to be positive with COVID-19, the ministry said. Apart from this, the government has also announced offer cash prizes of up to $1,325 to security experts for identifying and reporting bugs and vulnerabilities.*www.financialexpress.com*

Dashboard for monitoring movement of migrant workers in India

India has launched an online dashboard to monitor and facilitate the smooth movement of migrant workers and their contact-tracing during lockdown across the country. To collect information and facilitate movement of migrants, the National Disaster Management Authority has developed the online dashboard -- National Migrant Information System (NMIS) -- on the existing NDMA-GIS portal. The portal will maintain a central repository and help the sending as well as receiving state and district to ask for and give their acceptance in an online format seamlessly.

The states can upload individual data on the portal. As many states have already collected migrant data, this can be integrated through Application

Programming Interface (API). The key data pertaining to the persons migrating has been standardised for uploading such as name, age, mobile no, originating and destination district, date of travel etc, which states are already collecting. The NMIS Dashboard is a geo-spatial platform as a decision-support system for current pandemic situation. *www.indiatoday.in*

Transerve Technologies to map spread of Covid-19

'Transerve Technologies' through its offering 'Transerve Online Stack (TOS)' has come up with a solution to map Covid19 density zones using geospatial technology. This advanced solution works on Predictive Analysis and uses layers of geospatial data to track, monitor, analyze and visually represent them into data stacks. These data stacks will help in route optimization in Covid positive zones that can further assist businesses in making statistically driven decisions.

Supply chain professionals across organizations and logistic companies are planning to extensively use geo spatial data for the route optimization of their vehicles by avoiding the red zones. Moreover, analyzing data of existing health infrastructure and census data sets and mapping it to those infected can help policymakers and concerned authorities in identifying COVID19 containment zones. Similarly, such analysis can also estimate the load on each corona testing center and help health officials to set up more labs or increase or decrease the capacity of existing ones depending on population density and distance to the testing laboratory. *https://online.transerve.com*

Chennai defence lab develops 'Kavasam' app

The Chennai-based Combat Vehicles Research and Development Establishment (CVRDE) has developed an app called 'Kavasam' to contain the COVID-19 pandemic. It is meant to ease the work of frontline workers, enable street-level surveillance and aid quicker decision-making by those in charge.The app facilitates geofencing of homes of those under quarantine to monitor their movement. An automatic notification will be sent to the super admin, epicentre head and team leader/police if the person moves 100m away from the location. *www.newindianexpress.com*

OCTOPUS fends off COVID-19 in Israel's hardest-hit city

OCTOPUS Systems, the integrated command and control platform, has announced success in mitigating the COVID-19 outbreak in Bnei Brak, Israel. The city of 220,000 people was the hardest-hit coronavirus hotspot in Israel, with 2,100 infections. To combat the virus and flatten the curve, Bnei Brak employed a joint task force made up of various government branches, calling on OCTOPUS to consolidate their security systems and databases.

Bnei Brak's population density is three times that of Manhattan's, and its residents don't use radio, television, or internet. In other parts of Israel, using cellular data was essential to battling the spread of COVID-19. In this town, there was no such option. OCTOPUS' command and control system is a platform for orchestrating many different systems, ranging from cybersecurity and physical security to fraud protection and more. It integrates all these systems and databases seamlessly and consolidates them into one brain.

OCTOPUS integrated 500 cameras throughout the city, as well as drones and observation balloons, and provided the task force with analytics from various data sources, such as City CRM, GIS, and multiple government databases. The platform created a centralized management system for hundreds of responders, 16,500 cases of food delivery each day, and 1,600 coordinated missions a day. It also tracked the health status of confirmed and unconfirmed cases of COVID-19, security personnel, and frontline workers via a customized mobile app. *https://octopus-app.com*

Dr Javad Ashjaee, founder of Javad GNSS dies

Founder of Javad GNSS, Dr. Javad Ashjaee, a GPS/GNSS pioneer and visionary, died on the morning of May 30, 2020, due to COVID-19 in Moscow, Russia.

Over the course of 37 years, Dr. Javad made an incredible and far-reaching impact in the GNSS community. He pioneered the world's most advanced GNSS technology through a multi-national effort that combined GPS and GLONASS and established more than a quarter century of partnership between Silicon Valley and Moscow. He was always proud of this "success story of cooperation". Javad was a true industry disrupter long before the term and concept became popular. His whole way of doing business was challenging and disrupting to the status quo.

While advancing his technology and business efforts, Javad never lost his roots as a professor. He always aimed to educate and elevate everyone around him, even if it was an entire industry. His most profound skill was not in his technology: it was his ability to bring people together rather than to draw lines between them. At the end of life what matters is not what we bought but what we built, not what we got but what we shared, not our competency but our character, and not our success but our significance. *www.javad.com*

Noa drone by Acecore Technologies

Acecore Technologies has released their third drone platform. The new Acecore Noa has a 20kg payload capacity that leaves nothing to be desired and the endurance of a full hour. Its six enlarged rotors give Noa the edge over the competition. It sports huge 28″ reinforced carbon fiber props and was designed to be the first drone to combine heavy lifting with endurance in harsh environments. Its six custom ace motors are mounted upside-down onto its true carbon fiber monocoque frame allowing users to operate the drone in 9mm/h downfall. *https://acecoretechnologies.com*

Drone delivery trial for NHS in Scotland to support UK COVID-19 response

UK drone delivery provider Skyports will conduct the trial and operate the flights using delivery drones supplied by unmanned aircraft-maker Wingcopter. These trial flights will be planned through Thales' leading drone operations management platform, SOARIZON, which offers digital tools to maintain compliant and safe drone flying operations. The trial will consist of two-way flights between the hospital and Mull and Iona Community Hospital in Craignure 10 miles (16km) away on the Isle of Mull. As COVID-19 testing rapidly gathers pace in the UK, the proposed delivery service will help to ensure that isolated communities have access to tests, delivered in a fast and efficient way. Currently, the majority of medical supplies and specimens are transported between the laboratory at Lorn and Islands Hospital, surrounding general practitioners' surgeries and other healthcare settings by sea and road, a long and complicated journey.

The two-week trial represents a crucial milestone for unmanned aviation in the UK. Under current rules, drones must always be flown within visual line of sight of the remote pilot. To undertake these more extended flights, the project team has been in close consultation with the CAA. *https://skyports.net*

Contact Inspection Drone Systems for Industrial Infrastructure

NASA has awarded Near Earth Autonomy (Near Earth) an SBIR Phase II Contract to Enable Aerial Close-Proximity and Contact Sensing for Inspection of Industrial Infrastructure. Effective inspection, especially structural non-destructive testing, is a key part of planning repairs and avoiding mishaps, and better tools are needed to catch potential failure. Current methods for non-destructive testing at heights require scaffolding, boom lifts, or rope lines, taking critical assets out of use, and putting inspection personnel at risk.

Near Earth Autonomy and Carnegie Mellon University's AIR Lab received NASA support to demonstrate a proof of principle system to advance industrial aerial inspection with close-proximity imaging and contact sensing. It is developing a small Unmanned Aerial System (sUAS) that can provide contact measurements and macro-imagery that inspectors can use for evaluation and recommendation of further actions. These aerial inspection technologies will enable safer and quicker inspection of large, complex structures, producing fused data sets for analysis. *www.nearearth.aero*

Drones are delivering defibrillators to 80,000 Residents in Sweden

Everdrone has announced it is now deploying a drone system that delivers Automated External Defibrillators (AEDs) to the scene of cardiac arrests. In doing so, bystanders will now have the ability to initiate life-saving measures while awaiting professional medical care. Out-of-hospital cardiac arrests affect some 275,000 individuals in Europe each year and carry a low survival rate of about 10%. Now available to more than 80,000 residents in the Gothenburg area of Sweden, the service is part of a clinical study in collaboration with Sweden's national emergency call centre, SOS Alarm, and the Centre for Resuscitation Science at Karolinska Institutet (KI). *www.everdrone.com*

First Remote Identification compatible drone tracker

In its vision to enable a sky where drones safely fly alongside manned aviation, INVOLI launches the sales of first Remote Identification (Remote ID) compatible drone tracker: KIVU.

At only 22 grams, KIVU is the lightest drone tracker on the market, it has 2 hours of battery autonomy and it is self-sufficient with an embedded chargeable battery, being also rugged and particularly easy-to- use. KIVU users will be able to visualize at the same time the tracked drone and surrounding air traffic, while benefitting from all the other advantages of the platform, such as dynamic geofencing around the drone, precise analytics tools and actionable insights. There are many drone applications which could be extremely useful to fight epidemics or to ensure respect of the rules, such as spraying disinfectants or broadcasting messages, and we hope the public will soon benefit from all these opportunities." *www.involi.com*

Garuda drones to sanitise Noida, India

Drone-as-a-Service (DAAS) provider Garuda Aerospace will soon start flying drones around Noida spraying anti-Coronavirus disinfectant while the contract for sanitising the star constituency Varanasi has been expanded, said a top company official. The company has bagged drone based sanitization orders from Nandikotkur Municipal Corporation in Andhra Pradesh and several corporates. *www.expresscomputer.in*

DroneShield chosen by the European Union Police

Australian technology group DroneShield has been selected by the European Union (EU) as the preferred anti-drone solution for its police forces. Under the agreement DroneShield will roll out its technology that can deactivate drones that appear as threats across a range of

police units in the EU. The ASX-listed company says it expects its agreement with the EU to produce "material" periodic sales over an extended period of time, with orders to commence from this quarter.

New multipurpose VTOL unmanned aerial vehicle ZALA

The new unmanned VTOL ZALA 421-16EV HD features a unique adaptive system for using the aerodynamic properties of UAV in all flight modes. It combines the latest scientific and technical developments of the company – it broadcasts the video stream in HD quality (1280*720), which allows the ground station operator to examine the streaming video in the detail. It was developed as a "VTOL" type – a hybrid of UAV aircraft and helicopter types. A unique advantage of this model is the ability of vertical take-off and landing, carried out in a fully automatic mode. *www.zala-aero.com*

Flirtey's new granted patent is instrumental for drone delivery

Flirtey has been granted a critical patent for the safe and precise drone delivery of packages. This key patent describes a combination of hardware and software that enables the delivery of packages by a drone, potentially lifting the package to pick it up, holding it securely and lowering it once at the point of delivery. Flirtey's drone delivers its contents by lowering a tether, while the drone is suspended in air, and once the package is delivered, it then retracts the tether. It invented this method of delivery to be the safest and most precise, and it has since become the standard for the drone delivery industry. *flirtey.com*

Trillium Engineering tests new HD55 Gimbaled camera system

Trillium Engineering has begun airborne testing of its lightweight, high-definition HD55 system. Designed for use on Group 2 and smaller Group 3 UAS, the new HD55 employs electro-optical (EO) and cryogenically cooled mid-wave infrared (MWIR) cameras, as well as an onboard image processor – all in a gimbal just 5.5 inches in diameter and weighing 1750 grams. It will have the same swept volume as its predecessor but will be slightly lighter and more capable than the trailblazing HD50.

Trillium personnel have been flight testing the HD55 on various airborne platforms, including a small multi-rotor drone and a manned Cessna aircraft, which serves as a surrogate for a fixed-wing tactical UAS. *trilliumeng.com*

FlytWare deploys autonomous inventory drones

California-based FlytBase has launched a new innovation in this growing field with the FlytWare Solution Partner program. Deploying autonomous drones, the FlytWare solution replaces manual inventory cycle counts for large warehouse or distribution centers, saving time and money with intelligent, automation software working behind

By using autonomous inventory drones, companies can also mitigate COVID-19 health risks for warehouse workers who would otherwise have to work close together with manual scans. *flytware.com*

Drones to seed burned land for Australian fire recovery

In a collective effort to restore Australia from wildfire devastation, XAG has joined the first-ever post-fire drone seeding operation on Lake Cobrico, Victoria. This project was funded by Department of Environment, Land, Water and Planning (DELWP) and managed by Heytesbury District Landcare Network (HDLN). It is the first time that agricultural drones are used to re-establish native vegetation within a fire-ravaged peat swamp in Australia. Due to the increasingly frequent, large-scale bushfire, Australia has been facing an unprecedented decline in biodiversity as well as substantial increase in greenhouse gas emission. Particularly, as one of the world›s largest terrestrial carbon reserve, peatlands have been experiencing drainage and fires, which contributes to 5% of global carbon emission. Immediate actions should be taken based on partnership to restore the country's damaged ecosystem. *www.xa.com*

KlauPPK Changes the Regulations on GCPs in Japan

Japan's Ministry of Land, Infrastructure, Transport and Tourism have re-written their UAV capture specifications based on results using KlauPPK technology. The "Guideline for work-type management using aerial photogrammetry (earthwork)" specifies the procedures to be used to perform aerial surveys. When KlauPPK technology is deployed, the use of GCPs is now optional. The tests conducted by GeoLink Japan proved that +/- 5cm XYZ accuracy can be achieved without GCPs, as verified with check points. *klauppk.com*

NIST seeks public input on use of PNT services

To bolster the resilience of the Global Positioning System (GPS) and the wide scope of technologies and services that rely on precision timing, the U.S. Department of Commerce's National Institute of Standards and Technology (NIST) is requesting information from the public about the broad use of positioning, navigation and timing (PNT) services, as well as the cybersecurity risk management approaches used to protect them.

The request, posted in the Federal Register, is part of NIST's response to the Feb. 12, 2020, Executive Order 13905, Strengthening National Resilience Through Responsible Use of Positioning, Navigation, and Timing Services. The order notes that "the widespread adoption of PNT services means disruption or manipulation of these services could adversely affect U.S. national and economic security. To strengthen national resilience, the Federal Government must foster the responsible use of PNT services by critical infrastructure owners and operators."

This request, aimed primarily at technology vendors and users of PNT services, contains questions designed to elicit a wide-ranging picture of how PNT is used across different sectors of the economy. NIST will use the answers to inform the creation of a profile document intended to improve the resilience of PNT technologies and services. This document will join the growing list of profiles made to help apply the NIST Cybersecurity Framework to particular economic sectors, such as manufacturing, the power grid and the maritime industry. NIST is accepting responses to the request until July 13, 2020. *www.nist.gov*

Russia's Glonass contractor to develop Angosat-2 satellite for Angola

The work to develop and launch the Angosat-2 telecoms satellite for Angola to replace its predecessor Angosat-1 that is out of order has been assigned to the Reshetnev Information Satellite Systems Company, the Energia Space Rocket Corporation (the satellite's previous developer) said.

According to the document, the Reshetnev Company will also assume all the rights and obligations for stating, maintaining and formalizing the rights to orbital frequency assignments. In addition, the Energia Space Rocket Corporation will transfer allocated but unspent funds for the satellite's development to the Reshetnev Company.

The Angolan side recognized the Angosat-1 telecoms satellite as unserviceable. At the same time, Energia reported that Russia and Angola had agreed on making the Angosat-2 satellite instead of the lost space vehicle. The Russian side will also provide C- and Ku-band frequency resources to Angola for communications while the second satellite is being manufactured. *https://tass.com*

Low-cost, high-accuracy GPS-like system

Roboticists at the University of California, San Diego, USA have developed an affordable, easy to use system to track the location of flexible surgical robots inside the human body. The system performs as well as current state of the art methods, but is much less expensive. Many current methods also require exposure to radiation, while this system does not. The system was developed by Tania Morimoto, a professor of mechanical engineering at the Jacobs School of Engineering at UC San Diego, and mechanical engineering Ph.D. student Connor Watson.

The researchers embedded a magnet in the tip of a flexible robot that can be used in delicate places inside the body, such as arterial passages in the brain. "We worked with a growing robot, which is a robot made of a very thin nylon that we invert, almost like a sock, and pressurize with a fluid which causes the robot to grow," Watson said. Because the robot is soft and moves by growing, it has very little impact on its surroundings, making it ideal for use in medical settings.

The researchers then used existing magnet localization methods, which work very much like GPS, to develop a computer model that predicts the robot's location. GPS satellites ping smartphones and based on how long it takes for the signal to arrive, the GPS receiver in the smartphone can determine where the cell phone is. Similarly, researchers know how strong the magnetic field should be around the magnet embedded in the robot. They rely on four sensors that are carefully spaced around the area where the robot operates to measure the magnetic field strength. Based on how strong the field is, they are able to determine where the tip of the robot is.

The whole system, including the robot, magnets and magnet localization setup, costs around $100. Morimoto and Watson went a step further. They then trained a neural network to learn the difference between what the sensors were reading and what the model said the sensors should be reading. As a result, they improved localization accuracy to track the tip of the robot.*www.sciencedaily.com*

High accuracy to even more drones and GNSS receivers

MakeItAccurate, the global GNSS data correction and processing service from Klau Geomatics, now supports more drones and more hardware. In addition to the DJI RTK units, "PPK" drones (such as Delair, Wingtra, Quantum, Intel and more) logging raw GNSS data, are now supported, making drone operations even simpler.

Operations flying in remote areas or BVLOS (beyond visual line of sight) often struggle with availability of CORS data or deploying base stations for RTK or PPK corrections within range of the mission. This service allows users to operate without the need to run a base station or source CORS data; no matter where they are on the planet. *www.makeitaccurate.com*

Septentrio adds Sapcorda service to its industrial GNSS receiver portfolio

Septentrio has announced that it hasentered into a commercial agreement with Sapcorda, a global provider of sub-decimeter GNSS corrections. Through this, Septentrio will pioneer an innovative no-hassle corrections integration into a new line of products for the high-accuracy industrial market. These new products will consist of Sapcorda's SAPA Premium corrections integrated directly into Septentrio's latest GNSS receivertechnology. *septentrio.com*

Swedish Maritime administration selects Teledyne CARIS

Swedish Maritime Administration (SMA) has selected Teledyne CARIS to provide tools for generalisation of bathymetric data in nautical charts. Through a competitive tender process, SMA has chosen Teledyne CARIS to provide CARIS BASE Editor as the solution for the generalization of bathymetric data in nautical charts. The software platform will provide the tools needed to generate contours and sounding selections using automated processes as much as possible. *teledyne.com*

NovAtel® delivers OEM7® driver built on Robot Operating System (ROS™)

Hexagon | NovAtel has released its first purpose-built driver, powered by Robot Operating System (ROS™), to support its industry-leading OEM7 family of GNSS receivers. The driver, developed by NovAtel engineers, provides an optimized interface enabling users to accelerate autonomous development projects by quickly incorporating NovAtel OEM7 receivers into custom applications. The driver is available for immediate download through the new NovAtel GitHub repository and as a ROS Binary Package for direct installation.

With the release of a NovAtel-developed OEM7 driver built on ROS, developers can now confidently access the critical data needed to build autonomy algorithms for academic investigations, ride-share programs, and other applications. *novatel.com*

GNSS modules as small as 4.1x4.1x2.2mm

Würth Elektronik's Elara line of GNSS modules comes both with and without integrated antenna. For sophisticated navigation tasks, the Erinome series uses all four global navigation satellite systems at top speed: GPS, GLONASS, Galileo and BeiDou.

All four modules can be operated in low-power mode and offer I²C in addition to the usual UART interface. Thanks to tools such as the Würth Elektronik Navigation Satellite Software (WENSS) and the evaluation board, developers who integrate satellite navigation into their product for the first time will quickly achieve optimum results. *www.we-online.com*

Trimble and Kuebix launch Community Load Match platform

Trimble and Kuebix have announced new capabilities for its Community Load Match platform, a solution that facilitates collaboration between shippers and carriers to optimize how freight moves throughout the supply chain. Kuebix is a Trimble Company and part of the Transportation Sector.

This latest version of Community Load Match marks the first milestone in achieving Trimble and Kuebix's mission of a connected transportation supply chain since Kuebix was acquired in January 2020. Now, Community Load Match enables shippers to use advanced matching capabilities to more easily find available carriers for their truckload shipments and leverage improved map visualization through Trimble MAPS. For carriers, these capabilities give them direct access to Kuebix's community of more than 20,000

Trimble R12 Receiver with ProPoint GNSS technology

The Trimble® R12 GNSS system is a high-performance solution for professional land surveyors that pushes the boundaries of what a GNSS receiver can do. Powered by the all-new Trimble ProPoint™ GNSS engine, customers can now collect data more accurately in challenging GNSS environments than was previously possible. Key features include:

- At least 30 percent better performance in challenging GNSS environments
- Survey-grade positioning using most combinations of GNSS constellations and signals
- Advanced tracking and GNSS signal management means superior RTK positioning in more places.

www.trimble.com

New marine receiver delivers ultra-precise position

A new marine-certified quad-band GNSS receiver, the LD900 from VERIPOS, delivers accurate and reliable positioning in demanding offshore environments. It can track four GNSS frequencies simultaneously to ensure a precise position is always available at sea. When combined with Apex5 correction services from VERIPOS, it delivers accuracy levels as precise as 5 cm (95%) to provide robust positioning for the most challenging applications, including deepwater drilling, seismic, construction, and survey. It tracks GPS, GLONASS, BeiDou, Galileo and QZSS constellations, and supports all VERIPOS correction services, which use Precise Point Positioning (PPP) to deliver centimeter-level accuracy across the globe. *https://veripos.com*

Broadening perspective with the new UltraCam Osprey 4.1

Vexcel Imaging released the next generation UltraCam Osprey 4.1, a highly versatile large-format aerial camera for the simultaneous collection of photogrammetric-grade nadir imagery (PAN, RGB and NIR) and oblique images (RGB). Frequent updates of sharp, noise-free and highly accurate digital representations of the world are essential for modern city planning. Enabling unprecedented flight collection efficiency at superior radiometric

and geometric quality, the UltraCam Osprey 4.1 sets a new standard in urban mapping and 3D city modeling.

Leading up to the 4th generation of UltraCam aerial imaging sensors, the system combines new and industry-leading customized lenses, next generation CMOS imaging sensors with custom electronics, and a best-in-class image processing pipeline to deliver imagery of unprecedented quality, in terms of detail resolution, clarity and dynamic range. The system pushes flight productivity to new levels, collecting 1.1 Gigapixels every 0.7 seconds. Customers can fly faster, cover more area and see more detail. *www.vexcel-imaging.com*

Harxon debuts ruggedized antenna HX-CVX600A

Harxon has launched a ruggedized GNSS antenna for applications subject to high shock and vibration environments such as i-construction machining applications. Integrated with reliable signal tracking and strong anti-interference performance, the IP69K ruggedized HX-CVX600A antenna provides end users with millimeter accuracy, durability and productivity. I-construction promotes the use of automated machines on construction sites to improve productivity and provide support to workers.

The Harxon HX-CVX600A offers full support for reliable and consistent satellite signals tracking, including GPS, GLONASS, Galileo and Beidou, QZSS, IRNSS and SBAS, as well as L-band correction services. *harxon.com*

SkyTraq launches small multi-band GNSS receiver

SkyTraq has announced a 12mm x 16mm size PX1122R multi-band RTK receiver for centimeter-level accuracy positioning applications. It works with all the four global navigation satellite systems using GPS L1/L2C, Galileo E1/E5b, GLONASS L1/L2, and Beidou B1I/B2I signals concurrently to maximize positioning availability even in difficult urban environments. Based on single-chip SoC design, PX1122R is currently the smallest size, lowest power, multi-band multi-GNSS RTK receiver module on the market.

The PX1122R is designed to deliver reliable, centimeter-level accuracy positioning for precision guidance of emerging autonomous unmanned ground or aerial vehicle, Internet-of-Things precise positioning, and also the traditional land surveying and precision farming applications. *www.skytraq.com*

NavVis launches NavVis VLX wearable mapping system

NavVis has announced the launch of NavVis VLX, a first-of-its-kind wearable mapping system that captures high-quality data in even the most complex built environments such as construction sites, staircases and small technical rooms. Its all-in-one reality capture capabilities include both survey-grade point clouds and high-resolution panoramas. The combination of high-quality data capture and a compact, economical design will transform the way AEC projects are captured with fast, efficient scanning for BIM and CAD applications, while also extending the scope of projects to new deliverables such as web-based digital twins.

NavVis VLX is equipped with two LiDAR sensors and is able to capture survey-grade point clouds using the SLAM technology that it has developed for its industry-leading indoor mobile mapping system, NavVis M6. *www.navvis.com*

Wingcopter awarded

UAV startup Wingcopter is named as one of nine winners of Germany's top global hackathon to kick-start humanitarian drone delivery. It partnered with UNICEF and the African Drone and Data Academy to develop a concept to deploy humanitarian drone delivery services. The goal will be to improve health supply chains during the COVID-19 pandemic and beyond. The group will receive up to $3.6 million to make the plan a reality. *https://wingcopter.com*

MARK YOUR CALENDAR

July 2020

Esri User Conference (Virtual)
13 - 17 July
San Diego, USA
www.esri.com

AEC Next Technology Expo + Conference
July 27-29,
Chicago
www.aecnext.com

August 2020

XPONENTIAL 2020
August 9-12
Boston, USA
www.xponential.org

September 2020

Commercial UAV Expo Americas
15-17 September
Las Vegas,
www.expouav.com

7th International Conference on Geomatics and Geospatial Technology (GGT) 2020
21-24 September
Royale Chulan, Kuala Lumpur, Malaysia.
http://ggt2020.uitm.edu

ION GNSS+ 2020
21 - 25 September
St. Louis, Missouri, USA
www.ion.org

October 2020

INTERGEO 2020
13 – 15 October
Berlin, Germany
www.intergeo.de

International Symposium on Satellite Navigation (ISSN 2020)
21-24 October
Nanjing University of Information Science and Technology, Nanjing, China

10th IGRSM International Conference and Exhibition on Geospatial & Remote Sensing (IGRSM 2020)
20-21 October
Kuala Lumpur, Malaysia
http://igrsm.org/igrsm2020

AARSE2020
26-30 October
Kigali, Rwanda
https://aarse2020.org

November 2020

23rd ICA Workshop on Map Generalisation and Multiple Representation (ICAgen2020)
5 - 6 November,
Delft, The Netherlands
http://varioscale.bk

Autodesk University
16-19 November
Las Vegas, USA
www.autodesk.com

ION

September 21-25, 2020
Exhibit Hall: September 23 and 24
St. Louis Union Station Hotel
St. Louis, Missouri

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